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JOURNAL OF DAIRY SCIENCE

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CONTENTS

ANNOUNCEMENT 1
RAYMOND A. PEARSON. Address at the Dedication of the New Dairy Building at the University of Nebraska 4
R. S. BREED and W. A. STOCKING. A Preliminary Report on a Series of Cooperative Bacterial Analyses of Milk 19
Report of Committee on Relations to Breed Associations 35
O. F. HUNZIKER. Specifications and Directions for Testing Milk and Cream for Butterfat 38
Report of the Committee on Statistics of Milk and Cream Regulations of the Official Dairy Instructors' Association 45

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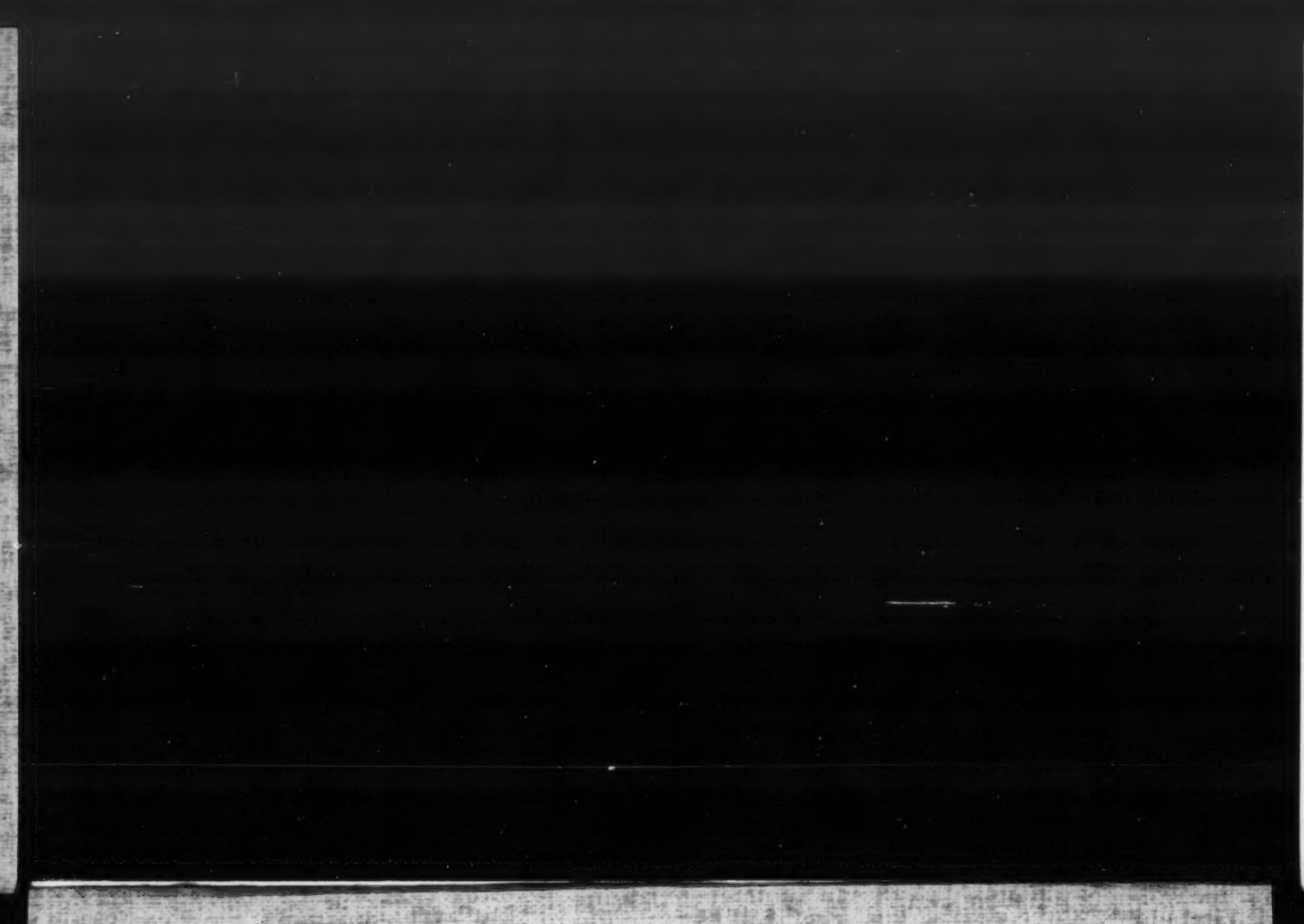

ANNOUNCEMENT

Although there are in the United States trade journals covering many phases of the dairy industry, there has, up to this time, been no medium for the publication of the scientific phases of the dairy industry as a whole.

The American Dairy Science Association, formerly the Official Dairy Instructors' Association, has established the JOURNAL OF DAIRY SCIENCE as the official organ of the Association and as a medium for the discussion of general and technical problems relating to the science of dairying, which confront the worker in every field of this important industry.

The JOURNAL OF DAIRY SCIENCE will publish abstracts of all papers read at the meetings of the Association and will print the most important papers and reports in full. Its columns will also be open for the publication of suitable communications by other persons, whether members of this Association or not. While it is planned to make the Journal in particular an organ for the discussion of the more fundamental and general aspects of the dairy industry, it will necessarily include many papers whose chief interest will lie in the technical problems which they present.

It will include in its scope problems in bacteriology in its relation to milk and milk products; studies in the chemistry of milk and milk products; nutrition of animals; market milk with respect to sanitation, public health and food value; scientific principles affecting the manufacture of butter, cheese, and ice cream, as well as condensed milk and milk powders, and other by-products of milk; scientific experiments and data relating to the breeding up of dairy cattle; engineering problems which relate to dairy machinery and construction; problems in cost accounting in milk production and in dairy management; new methods in laboratory technique, together with such other material as will be of value to the dairy industry as a whole.

The PUBLICATION MOVEMENT began in 1913 when the writer, in his presidential address to the Dairy Instructors' Association, made the following plea for the establishment of the JOURNAL OF DAIRY SCIENCE as the official organ of the Dairy Instructors' Association:

"In order that the association may accomplish the great tasks that lie before it, it should have the hearty support of all who are engaged in the various instructional and investigational lines of dairy work. In my estimation this can best be accomplished by some method which will give the association more prominence and publicity than it has enjoyed in the past. The American Chemical Society has built up and is able to hold its remarkable membership largely because of the activity and loyalty of those in the organization and the importance of the journal which it publishes. No chemist with a desire to keep abreast of the times would fail to retain his membership in the Chemical Society, for through it he has easy access to all the publications of the Society. This Chemical Journal affords a ready means for the immediate publication of important committee reports, special papers, abstracts and original investigations by any of its members. In my estimation, a journal published by our Association, either quarterly or monthly, would be of almost as great service to its members. It would give the Association an opportunity to publish committee reports, outlines for courses of study, and new official methods without needless delay. It would also provide for the publication of such original data as the members of the Society may care to contribute immediately upon its completion. It would also afford an excellent opportunity for the publication of such experimental work and observations as may be of interest to all engaged in this line of work, but of such nature that it may not be desirable to publish in bulletin form.

The American Chemical Journal derives its principal means of support from the advertising matter which it carries. It ought to be even easier to secure financial support for a publication which is the official organ of an association that is backed by a billion dollar industry. Additional revenue could also be derived from the regular subscription price which such a publication teeming with information on dairying would command.

Believing that a publication of this nature would be a great stimulus to all who are interested in the various branches of work undertaken by this association, I urgently recommend the appointment of a committee

to look into the desirability and feasibility of the publication of such a journal."

This met with such response that a committee was appointed to investigate the feasibility of establishing such a journal. The committee gave much study to the matter, held a number of meetings and considered numerous plans. However, it was not until the summer of 1916 when the Dairy Instructors' Association met at Amherst and again at Springfield, Massachusetts, that the committee was able to lay before the Association a proposition at once feasible and practical and which resulted in the Association authorizing its executive committee to appoint an editor-in-chief and approve committee of publication contract with the Williams & Wilkins Company for the publication of a bimonthly journal.

Change in Name of the Official Dairy Instructors' Association. In as much as the Official Dairy Instructors' Association, at their last meeting, voted to make a change in the name of the Association, your editor deemed it best to withhold the first issue of the Journal until the new name had been definitely decided upon. Dr. Harding, as Chairman of the Committee having this matter in charge, has just reported that, as a result of a post-card vote, the members of the Association have decided that in the future the Official Dairy Instructors' Association shall be known as the American Dairy Science Association.

This name, having been adopted, it seems particularly fitting that the official organ of this Association should be known as the JOURNAL OF DAIRY SCIENCE.

J. H. FRANDSEN,
Editor-in-Chief.

ADDRESS AT THE DEDICATION OF THE NEW DAIRY BUILDING AT THE UNIVERSITY OF NEBRASKA.

RAYMOND A. PEARSON

President of Iowa State College of Agriculture and Mechanics Arts

January 17, 1917

Twenty-one years ago, in 1896, your speaker was called upon to prepare a report upon dairy education in the United States. Every state was canvassed. The report published by the United States Department of Agriculture contained the following in reference to the dairy instruction equipment at the Industrial College of the University of Nebraska: "A dairy house has just been completed; it contains a large workroom and two classrooms. Apparatus consists of hand separators, deep-setting cans, and necessary utensils for making butter as in a home dairy." It was added that a twelve weeks winter farm dairy course was offered. A fee of $1.00 was charged for this course, and it was announced that suitable board and room could be found in Lincoln at $2.75 per week. The statement was made in the report that when the need for education along dairy lines is more clearly recognized and the good resulting from such education is better appreciated, even better facilities for instruction will be offered. This prophecy now has come true in Nebraska, and in larger measure than anyone then would have dared to hope.

We have assembled to dedicate this splendid building to the further promotion of your dairy interests. I am highly honored by your invitation to speak on this occasion.

This building means different things to different people and groups of people. To the architect it means a building that compares well with other university buildings here and elsewhere—its lines and proportions and visible materials of construction are pleasing to the eye. He has taken care to plan a

building that will be substantial and fireproof and well adapted to the peculiar needs as these have been explained by the experts.

To the builder it has a different meaning. It represents a certain cash value in materials, labor, and supervision in the form of a building 141 feet long and 64 feet wide having three stories and a basement and with a wing 60 by 70 feet having one story, and a basement. Undoubtedly it means good workmanship and undoubtedly it has meant to the builder many anxious hours caused by the exacting requirements of such a building and by the difficulties that have confronted all builders on account of changing values and prices.

To the owners, the people of Nebraska, this building represents the investment of nearly $200,000 for the promotion of one of the most important branches of agriculture. This is a large amount of money. A good many of us will work a life time and never get within touch, sight, or hearing of a quarter or an eighth as much. But it is not a one-man building nor a four-man building nor an eight-man building but a building belonging to and adapted to serve every person in the state. Its cost is equivalent to about sixteen cents for each person in the state and nothing better could happen to this building than for each person in the state to realize that he or she has an investment here. Sixteen cents per capita in such a building as this is not very much when compared with the average amount of money spent by each person in this nation each year for candy and chewing gum,—about $2.00. The money so used in this country in a year would be enough to erect about three such buildings as this every day in the year; the tobacco expenditures would do as much, and the liquor expenditures about four times as much more. In other words, this nation expends for liquor and tobacco and candies in a year enough money to pay for about eighteen such buildings as this every day in the year. On a pleasant summer day the insects in the United States eat up values amounting to fifty such buildings as this.

But to those citizens of the state who are especially interested, and particularly to the governing board of this university, the

chancellor, the dean, and the staff members who will use this building it means very clearly a recognition of work done and an opportunity to increase a most useful service to the state.

I desire to refer to certain phases of development in the field of dairying and in the field of education which appeal to me with much force at this time.

First, this building is a recognition of the great importance of dairying, one of the leading industries of the country. Praise for the dairy cow has been heard in the halls of congress and of legislatures. We have been told how she emigrated to the west with the early settlers, and how she has furnished milk, butter, cheese, meat, leather, glue, hair, and fertilizer; how she has lifted mortgages and provided an income when all else failed. She even has been called our "foster mother." But she never can receive all the credit that is her due.

In the United States there were in 1850, 6½ million milch cows, 275 to each 1000 persons, and their average production was 166⅔ gallons of milk per year. In 1870 there were 9,000,000 cows, 232 to each 1000 persons, with an average production of 206 gallons. In 1890 there were 16,500,000 cows, 264 per 1000 people and their average production was reported as 315 gallons per year. In 1910 there were about 22,000,000 cows, 220 per 1000 persons, and their average production was reported as 362 gallons per year. It will be noticed that the number of cows per thousand people has decreased, but this is practically offset by the increase of milk production.

In Nebraska, the development of dairying has been rapid. The United States census first reported the number of cows in this state for 1860 when there were 5 less than 7000, which was 241 per 1000 people, and the average yield was 149 gallons. In 1870, the number had increased to almost 29,000 or over 400 per cent in 10 years. There were then 235 cows per 1000 people and the average rate of production was 165 gallons per year. In 1890 the cows had increased to 505,000 in number or almost 1700 per cent in twenty years. There were then 477 milch cows per 1000 persons and the average rate of production was 287 gallons per year. In 1910 there were reported 640,000

milch cows, or 537 milch cows per 1000 persons, and their average production was reported as about 323 gallons.

In 1890 Nebraska ranked as the twenty-sixth state in population and twelfth in the number of milch cows. Since then the cow population has made relatively the larger progress.

In 1880 nearly 10,000,000 pounds of butter were made in Nebraska, and in 1910 the quantity had increased to practically 50,000,000 pounds. In 1880 almost all of the butter was made on farms, while in the last census year about one-half was made in factories. In 1896 a dairy investigator traveling through this state called attention to the advanced development of dairy farming in the eastern portion of the state, and especially the southeastern portion, and he mentioned that exceptional dairy districts were found in some of the northwestern counties. At that time much farm made butter was finding its way to the ladlers or dealers in low grade butter. The development of creameries and shipment of cream long distances have produced profound changes in the character of dairying in this entire section of the country. The number of creameries made a rapid increase when this system of butter-making was finding favor in this country. From 1880 to 1890 the creameries in Nebraska increased from 21 to 58.

It is worthy of note that the surplus of dairy products available for export has been steadily decreasing in recent years. In 1880 over 39,000,000 pounds of butter were exported. In 1890 the quantity had fallen to 29,000,000 pounds. In 1892 it was reduced to 15,000,000, and in 1913 just before the European war it was only 3,500,000 pounds. Cheese exports also have fallen off rapidly. In 1881, 147,000,000 pounds were exported; in 1891, 82,000,000; in 1901, 40,000,000; and in 1911, 10,000,000. In 1910, the exports were only 3,000,000.

These export figures tend to prove the statement that dairy products are more and more favored as a food by the people of this country. Particularly they are learning the food value of milk and consuming increased quantities. Government experts say that about 16 per cent of the ordinary American diet consists of dairy products. And these are among the cheapest

of our foods from animal sources. For example, 1 quart of milk costing 9 cents contains as much food value as 8 eggs worth 32 cents, at 48 cents per dozen; or as much as $\frac{3}{5}$ pound of ham worth 21 cents, at the rate of 35 cents per pound; or $\frac{3}{4}$ pound of beefsteak worth 18 cents, at 24 cents per pound; or 2 pounds of chicken worth 50 cents, at the rate of 25 cents per pound. And one pound of butter at 45 cents contains as much nourishment as 14 pounds of potatoes worth 48 cents, if potatoes are $2.00 per bushel. One pound of cheddar cheese, worth 30 cents, is represented as having food value equivalent to 1.4 pounds of ham worth 49 cents, at the rate of 35 cents per pound, or 1.7 pounds of beefsteak worth 41 cents, at the rate of 24 cents per pound. More and more a variety of dairy products is being developed to cater to all tastes. Ice cream has become a popular year-round article of food. It is estimated that in the United States about 200,000,000 gallons of ice cream are consumed in a year.

The enormous business developed on account of the sale of dairy products may be imagined from the fact that the United States census reports the estimated value of the dairy products of farms (excluding home consumption) as $656,000,000. This item may be made much larger by the addition of the dairy products not produced on farms and by attaching retail prices such as are paid by the ultimate consumer instead of wholesale prices or farm prices as reported by the census. Among the many reasons why the dairy industry deserves to be encouraged are the facts that it furnishes employment throughout the year and it builds up rather than depletes the soil. The fertilizing constituents removed from the soil in one ton of timothy hay are worth $5.78; in one ton of clover hay, $11.38; in one ton of wheat, $9.59; in one ton of oats, $9.97; in one ton of corn fodder and ears, $8.76, and in one ton of butter, 64 cents.

Second, this building stands as a recognition of the development of dairy cows and the improvement of methods of dairying. In these respects the dairy industry has been transformed in recent years. Records of production have been made and broken repeatedly until now the largest record is held by the

Holstein cow Duchess Skylark Ormsby with a credit of 1205.09 pounds of fat; the record for Guernseys is held by Murne Cowan with 1098.18 pounds of fat; for Jerseys it is held by Sophie 19th of Hood Farm with 999 pounds 2 ounces of fat; and for Ayrshires the honor is held by Lily of Willowmoor with 955.56 pounds of fat. These figures furnish eloquent testimony as to the work of the dairy breed associations which through their systems of registry and advanced registry or other recognition for superior animals are doing much to bring up the average yield in almost every dairy district.

The great majority of cows are not pure bred and the work that is being done in connection with these animals by the dairy test associations is worthy of special mention. Mr. Helmer Rabild of the Federal Dairy Division reports 346 coöperative cow-testing associations in active operation on June 30, 1916. These associations are located in 38 different states. Their number has increased 64 per cent in the last year. Their membership reported nearly 9000 herds having slightly over 150,000 cows under monthly test. In an Iowa cow-testing association that has been in operation four years, the average production of the cows increased from 6483 pounds of milk with 246 pounds of butter fat to 8648 pounds of milk with 312 pounds of butter fat.

A Michigan association reports for six herds which have been under observation continuously for nine years an average gain of 685 pounds of milk or 51.8 pounds of fat, the average percentage of fat having increased from 3.91 to 4.29. The average profit, which is the more interesting because of large increases in cost of grain and roughage, increased from $21.71 to $36.13.

The advances in dairy methods include such notable changes as the introduction of the centrifugal separator, the general use of the Babcock milk test, the use of starters in butter making, the development of combined churns and workers, the perfection of methods of pasteurization, the introduction of the dairy score card, the development of the certified milk movement, the production of condensed and powdered milk, the use of milking machines, and still other improvements more or less familiar to dairymen in this state.

When discussing improvement of dairy methods, it is necesdary to mention the results that have come from coöperation in manufacturing products and in making sales. The greatest progress through such organizations has been made in the little countries of Denmark and Holland. They have learned that it pays to produce good quality, and dairymen have found it to their financial advantage to combine and employ expert assistance to make tests of their products and to advise as to methods.

In all the developments that have taken place, the dairy departments of our colleges have been prominent because of their wise leadership. They have all worked together and the dairy department of this university has taken a prominent place in the progress that has been made. I am glad to give credit to Professor Frandsen for the excellent work he has rendered not only here but in a much larger field.

In the third place, this building is another evidence that the American people recognize the importance of making good provision for giving instruction in the fundamental and vital industries of our country. The state of mind of the public on this question has undergone great change in the last few years. People are coming to recognize that agricultural education is a question which concerns the general public even more than the farming classes. Our population is increasing faster than our food production. James J. Hill saw this a few years ago and prophesied that the nation would go to bed hungry within twenty years if the development of agriculture did not receive proper attention. Only three days ago an item of news was flashed over the country from Washington to the effect that our food supply has not kept pace with our growth in population. Records for the last sixteen years, the news item states, show that the population has grown about 33 per cent while there has been a decline in per capita production in foods constituting about 75 per cent of the country's diet. It is pointed out that the output of meats fell from 248.2 pounds for each person in 1899 to 219.6 in 1915, and milk fell from 95.6 gallons for each person in 1899 to 75.5 gallons in 1915. Meat and dairy products, which furnish 37 per cent of the food used on the American

table, fell from 248.2 pounds for each person in 1899 to 219.6 in 1915. Cereals, which supply 31 per cent, declined from 43.9 to 41.2 bushels.

Principal food products of export have been declining steadily. Formerly, large numbers of live cattle were exported. The average at the beginning of this century was about 500,000 per year. In 1915, less than 6000 were exported. Similar reports are made on live sheep and swine. Fresh beef, exported annually at the beginning of this century at the rate of about 300,000,000 pounds per year, fell to less than 7,000,000 in 1914. As would be expected, there was a considerable increase in 1915. Fresh pork was being exported at the rate of about 26,000,000 pounds seventeen years ago. In 1914, the quantity was less than 3,000,000. There was very little increase in 1915. Wheat was being exported at the rate of about 90,000,000 bushels per year at the beginning of this century. In 1912 the exports had fallen to 30,000,000, but they have considerably increased during the years of the war. Corn has fallen from 85,000,000 to 40,000,000 with a slight increase during the last three years. And exports of oats have fallen from about 12,000,000 to 2,000,000 bushels per year with considerable increase since the European war began. Furthermore, our imports show beef and corn from Argentina, potatoes from Europe, butter from the South Sea islands, and even eggs from China.

These are some of the reasons why bankers and lawyers and other thoughtful people who do not live on farms are coming to appreciate the importance of agricultural education. I fear the problem is much larger than most of these gentlemen appreciate. It involves profits from one's industry. The recent surveys made by government and state officials in various states have shown that a considerable number of farmers are not receiving even ordinary day wages for their labor after allowance is made for reasonable return on their capital invested. This question, together with the question of providing some of the advantages of the town to the people in the country, has a most important bearing upon the future of our agriculture. Our friends not living on the farms who have become alarmed about their future

food supply, should give careful consideration to these deeper phases of the question, for without proper attention to them the difficulties that are now becoming known cannot be remedied.

This whole matter is closely related to the attitude of the public toward the natural resources of the country. These have been exploited without regard to posterity and even without regard to our own old age.

The construction of this building is a hopeful sign. When the busy and successful people of a great commonwealth resolve to put their good money into a building where instruction will be given in dairying, it shows a conception of the whole subject of our future prosperity that is encouraging and that should be made known to the people in all states.

In New York State, with its great population, the subject of food supply has become so serious that state and city committees have been investigating, and these committees have united in a recommendation that the system of agricultural education should be strengthened and expanded. The joint recommendations contain these words:

> State agencies for agricultural education and research are a prime requisite in this connection. The state should lose no time in extending the work already under way at its various agricultural institutions. We recommend that these institutions be instructed to submit plans and estimates as to what will be required to extend their facilities in the way of additional buildings and equipment and the securing of a larger staff.

The report then proceeds to show that in the United States we are far behind European countries in respect to these developments. It points out that during the last five years Norway, with a cattle population of 1,100,000, expended $650,000 for a new veterinary college and equipment. The joint recommendation states: "We believe the time is ripe for this state to render all the aid it possibly can and offer all the inducement it possibly can to people who will engage in farming in this state. We believe that no better investment could be made on behalf of the people than appropriations by the legislature along these lines."

In the fourth place this building is another proof that the dignity of education in the industries is coming to be recognized by the American people. Here in the middle west we would naturally expect the public to regard education in agriculture as highly as equivalent education along any other line, but both east and west we still find objectors. They are a remnant of a considerable group who looked down upon education in agriculture fifty years ago and some of whom never could become reconciled to this kind of education. It is necessary that the dignity of agricultural education be recognized for three reasons:

First, because it is worthy.

Second, because unless agricultural education is so recognized it will be avoided by the ambitious, talented American boy, who is unwilling to cast his lot in a field where he might be estopped in his progress.

And again recognition *must* be given because of the splendid work in investigation and education that has commanded our attention during these recent years. I say that education in agriculture is as dignified as equivalent education in any other subject; for example, the law. To understand the sciences that relate to agriculture is to understand God's laws. Can anyone say that this is less dignified or less worthy than to be an expert in the knowledge of man's laws? Is there any reason for saying that one who understands the laws that govern the struggles of myriads of bacteria in the soil is less worthy than one who understands the laws that govern the location of line fences or trespass on top of the soil.

As to the attitude of the American boy, this was clearly described in a remarkable letter written by the Honorable Charles B. Calvert of Maryland in 1852. He was interested in a plan to establish an agricultural college and experimental farm. He wrote as follows:

> The agricultural community have long felt the want of such institutions, and it is to be hoped that the present generation will do something to elevate the standing of the profession, by establishing colleges and schools, which will enable the sons of agriculturists to obtain, not only a *liberal*, but a *professional* education. The learned

professions as they are commonly termed, have engrossed most of the talent of all nations. Is it because those professions are more honorable in themselves than agriculture? Certainly not. Is it because they require more talent, learning and energy? It will not be pretended that they do. Then why is it that you find the most talented and promising sons of agriculturists, deserting the profession of their fathers for some one of these?

It is because they are endowed by nature with a certain ambitious thirst for distinction, which they feel can only be gratified by uniting themselves with some one of these professional combinations. What is the remedy necessary to remove this incubus which is consuming our vitals? Simply, education—for so soon as you give a professional, and at the same time a liberal education to the farmer, you at once arouse a professional pride to make his own the most honorable of all pursuits; and it is only necessary to arouse this pride to enable the agricultural community to take the position which their intelligence and numbers entitle them to. It cannot be denied that the agricultural community compose the great conservative power of this country —and it is impossible to disguise the fact, that we are daily departing from the great principles laid down by the wise men who formed the happy government under which we have become a great and powerful nation. We see daily combinations formed in large cities to manufacture public opinion in favor of some scheme originated solely for the benefit of some selfish individual or political party, without any regard to the great interests of the country. If, on the other hand, the agriculturists were, as a body, liberally and professionally educated, they would take that stand in the political community which their numbers and interests entitle them to, and thereby control such matters; and I therefore trust that you will see the importance of such an establishment in our state, and will give it your active support, by obtaining as many and as large subscriptions as possible.

This letter is a classic, true in its day and just as true at this time.

My argument is that agricultural education needs to be more generally recognized as dignified. I know and you know that it is dignified, and it makes a favorable comparison with any other kind of education; in fact some of our best scholars have frankly acknowledged that the whole subject of research in this country has received an impetus from the research work done

recently in the field of agriculture. One historian records the fact that the work of research in a few state universities began in their departments of agriculture. From these departments the endeavor for scholarly research extended into the departments of liberal arts and science.

Today it is amusing and sometimes sad to read of the struggle for recognition made by a few who were first to see the need and the worth of education along industrial lines. About 1840, according to Dr. Dabney in his "Education in the United States" President Francis Wayland of Brown University became interested in scientific and technical education. He wrote a book on the collegiate system of the United States and argued earnestly in favor of placing scientific subjects in the college curriculum. He succeeded in securing a science hall and a museum of geology at Brown Univerity, but Francis Wayland was ahead of his time. Support was withheld from his scientific courses and he was forced to resign in 1855 and the old classical course was reestablished. President Wayland had studied the enrollment at New England colleges and found the number of students to be decreasing in spite of increases of endowments and reduction of tuition. He wrote:

> It would seem from such facts as these that our present system of collegiate education is not accomplishing the purposes intended. Our colleges are not filled because we do not furnish the education desired by the people. . . .
>
> We have in this country 120 colleges, 42 theological seminaries, and 47 law schools, and we have not a single institution designed to furnish the agriculturist, the manufacturer, the mechanic, or the merchant with the education that will prepare him for the profession to which his life is to be devoted.

A monument in memory of President Francis Wayland should be erected by us who believe in a magnificent dairy building upon the campus of a great university.

The early educators simply could not understand. One who was interested in Greek made an attack upon "the butter makers across the campus" for holding their subject on a par with Greek as a part of university education. But in 1896

President Walker of the Massachusetts Institute of Technology referred to the oldest university of America conferring its degree upon those who had never had an hour of either Latin or Greek within its walls and even dropping Greek from its list of entrance requirements. He says:

> We get a measure of the enormous advance in educational philosophy which has taken place since President Wayland dared to challenge the opinion then universally held by the teachers and governors of American colleges and universities, that the classics were absolutely essential to liberal culture and that no one could be called well educated without them.

Members of Congress also failed to understand the situation. In 1859 Mr. Davis argued in Congress against the Morrill land grant and he said:

> I have seen the growth of the proposition to do something for the agricultural interests of the country and I believe it was always delusive not to say fraudulent. It needs no aid. The agricultural interest takes care of itself and is drained to take care of every other pursuit in the country. . . . Agriculture needs no teaching by Congress. The wide extent of the country, the great variety of its soil and climate and products render it impossible that there should be anything else than local teaching in relation to agriculture.

Times have changed. The man who teaches cow test association work and how to conduct egg laying contests is coming to be looked upon throughout the length and breadth of the land with as much respect as the one who teaches arithmetic, physics, or grammar. All these subjects are important, all are vital. The American boy now will make no mistake in selecting the one which appeals strongest to his individual interest.

Fifth. I have said that this building stands as evidence of the great growth of the dairy industry and the great development of dairy methods, also that it emphasizes the enlightened attitude of the people of this state toward education which is directly applicable to our chief vocations, and that it is a proof that the dignity and worth of such education are appreciated. But all this represents a look backward. If the building stood for nothing

more than what has been mentioned it would be a monument to the past. It is that and it is a starting place for the future. We dedicate it not to the past but to the future, to a service begun now and no one would venture to say how great this service will be nor how far it will extend. We are able to foresee only certain further developments along the lines already started. Much needs to be done along these lines. The problems of feeding need further study, the economy of milk production, the further development and extension of sanitary methods, and the instruction of all people as to the wholesomeness and relative cheapness of dairy products as food, with the creation of new varieties of dairy products—all these problems will receive attention in due time and doubtless investigations in this building along these lines will attract not only statewide but nationwide and worldwide attention. The job of the discoverer of new lands to subdue has been transferred to the scientist. There was a time when our nation could increase its production in any line by finding new lands that could be adapted to the purpose desired. We now have reached the time when if we would increase our production we must appeal to the scientist to show us how it can be done; to show how one acre may take the place of two, or one cow may serve as well as two.

But the scientists engaged here are likely to find themselves working upon problems that today are utterly unthinkable. We must not assume that we have reached the limit of the field of knowledge. Surprises are in store for us now the same as they were in store for us thirty or forty years ago. Who then could have had imagination enough to foretell the developments which we have witnessed, and these are no more remarkable in the field of engineering than in the field of agriculture. Forty years ago a thoughtful business man remarked to some friends that the time would come when street cars would be driven by electricity. His prophecy was received with laughter. Can you imagine the surprise of the young Dutchman who first made a lens and through it saw forms of life which no one knew existed? Steadily our scientists are opening up new worlds. We cannot think that the last word has been said in the development of

dairy science. Experiments being conducted at the Wisconsin experiment station suggest a wonderful development in dairying. Two scientists have been studying the differences between milk fat and other kinds of fat. They have carried a little farther some studies that to a layman seem quite mysterious. It may be that their work will mark another epoch in dairying, but it is useless to attempt to foretell the future.

The greatest need of our world today is big men with big ideas. This need is felt in every field. Here you have laid a broad and firm foundation for the development of such men in the field of dairying. Such men and others similarly trained in other fields will control the future of our country. They will stand a little higher and see a little farther than their fellowmen. Like the pilot who stands on the highest point of the ship with his head just above the fog which blinds the people on the decks below and who is able to see clearly the course that should be followed, so these trained men located in this building and their students located in all parts of the state will be the leaders in attacking new problems and overcoming new difficulties and thus will help the people of Nebraska to maintain and further advance their high standing at home and the high standing of their state among her sister states.

To such high purposes this building is solemnly and reverently dedicated.

A PRELIMINARY REPORT ON A SERIES OF COÖPERATIVE BACTERIAL ANALYSES OF MILK[1]

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AND

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Ithaca, New York

[Analytical work done by A. M. Besemer, H. M. Pickerell, T. J. McInerney, and G. C. Supplee of the New York State College of Agriculture at Ithaca; and R. S. Breed, J. D. Brew, H. J. Conn, W. D. Dotterrer, and G. L. A. Ruehle of the New York Agricultural Experiment Station.]

Some of you will remember the report which Prof. H. W. Conn gave of the results of the extensive series of analyses which had been carried out in New York City in 1914–15 under his direction. Lest you have forgotten let me read you the conclusions[2] which he reached after the first series of analyses had been completed.

"1. Under the ordinary conditions of laboratory analyses, results of different laboratories in analyzing two different samples from the same bottle of milk cannot be relied upon as giving any close approximation to accuracy.

"2. Single analyses of milk samples cannot be relied upon. Not only is every laboratory liable to make some unrecognized slip in technique, so as to give a single widely divergent result, but even where there are no palpable errors, individual results occasionally diverge noticeably from the general average. Hence, no milk analysis should be reported upon except as the average of two or more tests. If four or five analyses are made, the results may be regarded as mod-

[1] Paper read before the Laboratory Section of the American Public Health Association at Cincinnati, October 24, 1916.

[2] H. W. Conn, Standards for determining the purity of milk, U. S. Public Health Service, Reprint 295 from Public Health Reports, August 13, 1915. 48 pp., 1915.

erately accurate; but under ordinary conditions of laboratory work, discrepancies are so great that reliance should not be placed upon a single plate count." (p. 17.)

After further series of analyses had been carried out in an effort to improve matters by standardization of the plating technique, he wrote the following cryptic sentence as his final conclusion.

"11. In spite of all these irregularities the results with duplicate samples in the four laboratories have been found, *within certain somewhat wide limits*, fairly accurate." (p. 45.) (Italics by authors of this paper.)

In view of the fact that all of our New York State market milk, both that for New York City and that for the rest of the state, is now graded on the basis of requirements in which agar plate counts made by the standard method figure very conspicuously, the results of this series of analyses was very disconcerting to our milk producers and dealers, to say the least. Moreover, the accuracy and value of many extensive research investigations were called into question at once.

The situation seemed to call for immediate action by those of us who were entrusted with the responsibility of investigating matters of importance to the dairy interests of the state. While we were at the American Public Health Association meeting in Rochester last fall, plans were drawn up for carrying out the present series of coöperative analyses. For evident reasons it is impossible to hurry such work if it is to be done with the care necessary to produce results of value so that the present report is only preliminary. The results secured, however, are of such general importance that we feel justified in presenting them.

PLAN OF WORK

The first work done was to carry out a series of analyses to determine whether the results secured in our laboratories by university men who were trained in research methods were as irregular as those secured in the commercial and control lab-

oratories who had joined efforts in New York City. To this end, four sets of samples of five each were analyzed by seven men, four working in the Ithaca laboratory (one of these a Geneva man working at the time at Ithaca) and three at Geneva. The samples were sent alternately from Geneva and Ithaca, train connections being such that the samples were ready for analysis within two or three hours after they were prepared. Each man was told to use such technique as he felt would give accurate results.

The summary in Table 1 will show the most important results secured.

COMMENTS

Plate counts

Technique. It is interesting to note that not one of the analysts was willing to use the incubation temperatures recommended by the Committee on Standard Methods (two days at 37°C.) All used prolonged incubation at two or more different temperatures. Four used a plain agar similar in composition to standard agar; the others used agars containing lactose or lactose and dextrose. One used a whey agar. In some cases the reaction of the media was adjusted, in other cases, it was not adjusted. Some clarified with egg or egg albumen. Others did not clarify. Four used pipettes with a single graduation mark, the others used pipettes with two graduation marks. There were many other variations in the details of making dilution, etc. All used three different dilutions and not one was willing to make fewer than triplicate plates from each. All microscopic counts were made in duplicate.

Table 2 has been drawn up in order to compare the variations in counts found in this series with those found in an equal number of the analyses made in New York City, the latter being selected in a random way from similar counts given in the second table of Professor Conn's report.[3] Bold faced type has been used to indicate the counts which show the greater variation.

[3] Loc. cit.

TABLE 1

Summary of the first series of cooperative milk analyses. Cornell-Geneva, 1915. Twenty samples analyzed by seven men (four at Ithaca, three at Geneva). Counts made by agar plate method, each man being allowed to use such technique as he thought would give the most accurate results. Counts also made by the direct microscopic method. All petri plates and smears recounted by a second person. Plated in triplicate, smeared in duplicate

SAMPLE NO.	AGAR PLATE COUNT	MICROSCOPIC COUNT		AVERAGE SIZE GROUP	NOTES
		Groups	Individuals		
1	10,200	18,700	52,000	2.8	Geneva station milk. Kept at 50° F. for 15 hours.
2	10,600	19,700	92,100	4.7	Geneva station milk. Kept at 50° F. for 27 hours.
3 and 5	6,000	5,030	7,920	1.4	Geneva station milk. Kept at 50° F. for 39 hours.
4	42,100	41,300	145,000	3.5	Geneva station milk. Kept at 50° F. for 51 hours.
6	88,500	46,400	185,000	4.0	Ithaca market milk. Iced for 24 hours.
7	72,300	46,800	201,700	4.3	Ithaca market milk. Iced for 24 hours.
8	30,500	51,500	207,600	4.0	Ithaca market milk. Iced for 24 hours.
9	97,900	80,400	383,000	4.7	Ithaca market milk. Iced for 24 hours.
10	285,000	94,000	721,000	7.7	Ithaca market milk. Iced for 24 hours. Numerous groups of bacteria containing from 10 to 400 individuals.
11	51,550,000*	93,190,000	99,480,000	1.06	Fresh milk heavily inoculated with a culture of long-rod lactic acid-bacteria from cheese whey.

12	47,600,000	49,900,000	67,450,000	1.3	Fresh milk heavily inoculated with colon bacillus.
13	135,090,000	40,200,000	162,816,000	4.0	Fresh milk kept at 37°C. for 24 hours. Scattered groups of micrococci of very large size.
14	9,867,000	5,930,000	150,200,000*	25.3	Market milk containing masses of long-chain streptococci.
15	1,982,000,000†	1,531,000,000	2,680,000,000	1.7	Milk souring normally with Bact. lactis acidi. Some samples curdled.
16	120,700	69,130	391,500	5.8	Ithaca market milk. Iced for 24 hours. Few streptococcus chains.
17	25,700	12,600	233,900	18.6	Ithaca market milk. Iced for 24 hours. Scattered large clumps of long-chain streptococci.
18	1,890‡	11,970	34,480	3.0	High-grade Ithaca market milk.
19	11,754,000	8,392,000	28,407,000	3.4	Ithaca market milk. Numerous groups 10 to 50 individuals.
20	5,644,000	5,238,000	26,599,000	5.1	Ithaca market milk. Many groups larger than 10 individuals.

* Counts low and irregular because organism did not grow well.
† Overcrowded plates.
‡ Too great dilution used.

The whey agar counts made by one of the Cornell men in the Cornell-Geneva series have been disregarded as they were markedly irregular.

In tabulating the results of the Cornell-Geneva counts it was found that a few large errors had been made simply through carelessness in arithmetic. These have been corrected in the figures given. The New York City figures are just as reported

TABLE 2

Maximum and minimum plate counts obtained in the Cornell-Geneva series compared with similar counts selected from the New York City series

CORNELL-GENEVA COUNTS				NEW YORK CITY COUNTS			
Sample No.	Minimum	Maximum	No. of analyses	Sample No.	Minimum	Maximum	No. of analyses
1	**2,300**	**14,550**	15	35P	1,200	9,500	7
2	6,300	16,000	16	24P	**500**	**15,200**	8
3 and 5	4,100	7,650	22	5C	1,200	6,700	7
4	28,000	87,200	6	40R	**14,000**	**150,000**	7
6	24,000	120,000	10	49R	**24,000**	**126,000**	8
7	26,500	122,600	10	39R	**30,000**	**250,000**	8
8	15,600	44,500	10	42R	**6,000**	**200,000**	7
9	90,000	150,000	10	56R	**11,000**	**280,000**	12
10	137,000	427,000	10	48R	**52,000**	**1,470,000**	8
11-15	Omitted as these were not random samples.						
16	69,000	1,490,000*	11	600P	**72,800**	**3,200,000**	11
17	**6,800**	**38,700**	11	45C	11,800	22,400	6
18	**700**	**5,000**	11	25P	300	4,200	8
19	7,630,000	18,470,000	11	700S	**2,200,000**	**165,000,000**	7
20	1,410,000	9,550,000	11	650R	**700,000**	**40,000,000**	11

* Plates apparently contaminated. Next highest count 202,000.

Bold faced type is used in each case to indicate which pair of counts shows the widest variation.

to Professor Conn and show evident arithmetical errors. On the other hand it should be noted that the Cornell-Geneva counts were made with very diverse technique while the New York City counts were all made by the standard method. In any individual case there were almost twice as many counts made in the Cornell-Geneva series from which to select these maximum and minimum counts.

If we use the limits of 10,000, 60,000, 200,000, and 1,500,000, the counts used in our New York State grading system, then there would have been nine cases of inconsistence in the grades given in the Cornell-Geneva series. None of these inconsistencies would have caused a raising or lowering of the classification of the milk by more than one grade. There would have been nine inconsistencies of grade in the New York City counts, five of these being enough to raise or lower the grade by two classes. A study of the three instances where the variation was greater in the Cornell-Geneva series (Nos. 1, 17, 18) shows that this was due, not so much to a poor showing by the Cornell-Geneva men as because of the fact that the New York City laboratories made an especially good showing on the corresponding samples. In the one case where the research men made a poor showing because of a set of apparently contaminated plates (No. 16), the showing in the corresponding sample was, by chance, more than twice as bad for the New York City laboratories.

It would appear from this that research men using their own technique may be depended upon to secure very much more consistent counts than laboratory assistants in commercial and control laboratories, working rapidly and using standard methods. However, even the results secured by the research men cannot be regarded as ideal.

The maximum count in the Cornell-Geneva series was reported by Cornell men 12 times; by Geneva men 7 times. The minimum count was reported by Cornell men but once, by Geneva men 18 times. Among the possible explanations of the lower counts secured by the Geneva men is the fact that the Cornell men all used sugar agars while the Geneva men used plain agars; also the fact that the two laboratories use different forms of 1 cc. pipettes. A similar but not so pronounced effect occured in the second series of analyses where all analysts used the same lot of agar. In a third series of 21 analyses of market milk and cream samples (not reported upon here) made by two men, one from Geneva and one from Cornell where both used the same lot of agar but

different pipettes as before, the Cornell man secured the higher count 15 times, the Geneva man 5 times, while one count was identical. Further tests are being planned in order to locate the cause of this elusive discrepancy. It is the more interesting because it is exactly similar to conditions noted by Professor Conn.

Microscopic counts

Technique. Only three of the men who made the microscopic counts can be regarded as experienced men so far as this technique is concerned, a fact which must be kept in mind in studying the results. Difficulties were met with in defining clumps and individuals and no perfect system was devised. Some men used the whole field of the microscope as a counting area while others used the much more satisfactory areas secured by the use of the special ocular micrometers described in Technical Bulletin 49.[4]

Forty-eight out of seventy-one of these maximum and minimum counts were reported by the four inexperienced men. As would be expected from the mathematical relations involved, the counts of individual bacteria show greater variation than the counts of groups of bacteria.

The average clump or group of bacteria contained from 1.4 to 7.7 individuals in the market milks, except in two instances where the presence of masses of long chain streptococci brought the average up to 18.6 and 25.3 respectively. The largest groups seen were masses of micrococci (presumably udder micrococci) which were found in sample No. 13. This was a high grade milk which had been incubated at 37°C for twenty-four hours, thus favoring the growth of udder forms. The masses were really compact colonies containing thousands of individuals.

Comparison between plate and microscopic counts

If the plate and microscopic counts are compared (see table 1), it at once becomes evident that the plate count does not

[4] Robert S. Breed and James D. Brew. Counting bacteria by means of the microscope. N. Y. Agr. Exp. Sta., Tech. Bul. 49, 31 pp., 1916.

compare exactly with either of the two counts made with the microscope. It corresponds more closely with the count of clumps of bacteria than with the count of individuals, but the comparison is not an exact one, chiefly because in the making of plates, the clumps of bacteria are broken up to a certain amount by the shaking and diluting of the sample. If the individual bacteria could be completely disassociated by this process and all grew into colonies the plate count would correspond to the count of individuals. With conditions as they are, the plate count is, under ordinary conditions, a count usually larger than the group count and much less than the count of individuals. However, the matter is complicated by the presence of bacteria which do not grow on plates, dead bacteria, and occasionally other things which frequently change this relationship.

In six instances, the plate count was less than the group count. In one of these (12), the difference was so slight as to be neglible; in another (11), the reason for it was clearly because of the presence of living bacteria incapable of growth on agar. The other four instances were of low count milks (1, 2, 8, and 18) where there may have been udder bacteria not capable of growth or dead bacteria killed by the cooling of the milk.

An examination of the maximum and minimum counts shows that less extreme variations were found in the series of plate counts made by the Cornell-Geneva men (table 2) than in any of the other 3 series. Also that the amount of variation found in the group counts (table 3) was approximately the same as that found in the series of plate counts made in New York City (table 2), while the amount of variation in the counts of individuals (table 3) is relatively enormous.

A superficial judgment would incline to the view that this fact shows the inferiority of counts made by the microscopic method. But there is more to the matter than appears on the surface. As a result of our studies, we are convinced that, with carefully standardized technique and well trained men, the amount of variation found in plate counts and in group counts

by the microscopic method would be approximately the same, though further studies are necessary before this fact can be regarded as established. The greater variations in counts found where counts of individuals are made, are due, not so much to faulty technique or inexperience of the analysts, as to the fact *that these counts give a faithful picture of the real conditions.* In other words, the greater regularity of the plate and

TABLE 3

Maximum and minimum group and individual counts obtained in the first Cornell-Geneva series of analyses.

	COUNT OF GROUPS		COUNT OF INDIVIDUALS		TOTAL NO. COUNTS
Sample No.	Minimum	Maximum	Minimum	Maximum	
1	5,000	35,000	**6,000**	**123,000**	11
2	2,700	57,000	**2,700**	**306,000**	11
3 and 5	Less than 3,000	21,000	Less than 3,000	**114,000**	17
4	1,800	120,000	**3,600**	**528,000**	11
6	9,000	1,090,000	**21,000**	**5,567,000**	10
7	9,000	93,100	**96,000**	**316,000**	10
8	4,500	190,000	**4,500**	**721,000**	10
9	18,200	180,000	**61,000**	**950,000**	10
10	29,500	184,500	**129,000**	**1,362,000**	10
11	**74,500,000**	**126,044,000**	74,560,000	126,044,000	14
12	32,500,000	88,200,000	**44,820,000**	**120,600,000**	14
13	**14,850,000**	**68,819,000**	109,140,000	297,210,000	14
14	**2,983,000**	**13,127,000**	61,500,000	302,694,000	14
15	667,200,000	2,675,000,000	**1,302,000,000**	**5,350,000,000**	14
16	9,000	131,250	**63,000**	**900,000**	14
17	3,000	33,000	Less than 5,000	**1,140,000**	14
18	Less than 5,000	60,000	Less than 5,000	**141,000**	14
19	**1,120,000**	**23,750,000**	6,300,000	88,487,000	14
20	**1,625,000**	**13,435,000**	13,700,000	55,080,000	14

Bold faced type used to show the counts which had the greater variation.

group-counts is in reality due to their being counts of groups of bacteria, while the irregularity of the counts of individuals is due to irregularities in the numbers of individuals in the clumps. In order to overcome the variations caused in this way, it would be necessary to examine a much larger amount of milk than is ordinarily examined when making counts by the microscopic method.

SECOND SERIES OF ANALYSES

Because of the consistent counts obtained on sample 12 (containing the colon bacillus), as well as similar results secured at other times, it was decided to carry out a second series of analyses on samples of milk containing the colon organism, trying at the same time to eliminate all probable sources of errors in count. The colon organism was chosen because it tends to grow singly or in pairs, is always found evenly distributed throughout a sample of milk, and grows well on all media at all ordinary incubation temperatures.

In order to have a series of checks and counter checks on the accuracy of the counts, it was decided to use but three lots of milk, analysing each in triplicate. These were prepared by inoculating one liter of a high grade milk with 2.5 cc., 5 cc. and 10 cc. quantities, respectively, of a skim milk culture of the colon bacillus. Thus the counts obtained from the samples were expected to show the ratio 1:2:4.

The samples were prepared at Geneva and the results showed that they were suitable for the purposes for which they were designed. In one respect they were not as perfect as those used for No. 12 in the earlier series, as it was found that masses of the organisms had formed in a thin film of cream which rose to the surface of the skim milk culture used for inoculation, so that occasional masses of bacteria appeared in the final samples which contained 10 to 30 or even more individuals.

Counts were made from these samples by the plate method, by the dilution method, and group and individual counts by the microscopic method. In making counts by the dilution method, 1 cc. quantities of suitable dilutions were added to sterile milk tubes in triplicate. These were then incubated for three days at 37°C. and then examined for growth. As these counts were made by one person only they cannot be regarded as having equal value with the other counts.

The results are summarized in table 4.

COMMENTS

Plate count

The most noticeable feature of the plate counts was their great regularity. The two highest and two lowest counts are given for each sample in table 5.

TABLE 4

Summary of second series of coöperative milk analyses. Cornell-Geneva, 1916. Ten samples analysed by six men (three at Ithaca, three at Geneva). Agar plate-technique standardized. One lot of agar used by all. (1 per cent Difco-peptone, 1 per cent lactose. 0.5 per cent Liebigs beef extract, 1.5 per cent agar). Microscopic counts as before. All petri plates and smears recounted by a second person. Dilution counts made by one man at Geneva. Plated in triplicate, smeared in duplicate

SAMPLE NO.	AGAR PLATE COUNTS	MICROSCOPIC COUNT		AVERAGE SIZE GROUP	DILUTION COUNT	NOTES
		Groups	Individuals			
1	390	3,000*	4,000*	1.3	Less than 100	Fresh milk drawn into a sterile pail.
2–4	397,000	262,000	476,000	1.8	About 300,000	One liter from Sample 1 to which 2.5 cc. of a skim milk culture of the colon bacillus had been added.
5–7	639,000	513,000	809,000	1.6	Less than 600,000	As above 5 cc. colon culture added.
8–10	1,381,000	995,000	1,570,000	1.6	Between one and two million.	As above 10 cc. colon culture added.

* Counts made by inexperienced men were omitted in computing these averages.

Theoretical ratio, 1: 2: 4.

Actual ratios: Plate-count, 1: 1.61: 3.48; group-count, 1: 1.96: 3.80; individual-count, 1: 1.70: 3.30; dilution count, 1: 2: 4±.

Troublesome spreaders were practically absent from the agar plates and they were in excellent shape for counting at the end of three days incubation. All counts were made from plates having more than 30 and less than 300 colonies per plate.

There were no cases where the recount of plates by a second person showed any marked discrepancies.

Microscopic counts

The microscopic counts were less regular than the plate counts. The effect of experience in counting by this method was very noticeable, 13 out of the 32 extreme counts noted in table 5 having been reported by the only man in the group who had not participated in the previous series of analyses. It was very clear also that the inexperienced men mistook objects for bac-

TABLE 5

Maximum and minimum counts obtained in the second Cornell-Geneva series

SAMPLE NO.	PLATE COUNT		MICROSCOPIC COUNT				TOTAL NO. COUNTS
			Groups		Individuals		
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
1	190	1,000	000	283,000	000	447,000	12
	220	570	000	298,000	000	380,000	
2–4	299,000	420,000	45,000	500,000	97,000	1,841,000	36
	301,000	405,000	97,000	458,000	131,000	1,748,000	
5–7	453,000	790,000	72,000	774,000	198,000	1,641,000	36
	453,000	767,000	186,000	765,000	308,000	1,116,000	
8–10	1,126,000	1,740,000	434,000	1,623,000	656,000	2,658,000	36
	1,140,000	1,636,000	570,000	1,477,000	745,000	2,586,000	

teria which were not bacteria in counting sample 1. This was in reality a high grade milk containing very few bacteria as shown by the plate counts, the dilution counts, and by the microsopic counts made by the experienced men. In some cases the inexperienced men found more bacteria in this milk, which was used as the base for the preparation of samples 2 to 4, than they did after the colon bacilli had been added to it. The most probable explanation is that the inexperienced men mistook stained particles for bacteria and counted them in sample 1. In samples 2 to 4, where unmistakable bacteria were present

in nearly every field of the microscope they disregarded these stained particles and in some instances clearly overlooked the bacteria. In other cases they found large masses of bacteria none of which were reported by the experienced men. All of these effects are chargeable to inexperience rather than to carelessness and were apparently little greater than similar effects noted where inexperienced men are set at the task of counting agar plates.

The amount of this effect produced by the inexperience of the men may be roughly gauged by comparing the maximum and minimum counts in table 6 with those in table 5.

TABLE 6

Maximum and minimum microscopic counts obtained by the experienced men in the second Cornell-Geneva series

SAMPLE NO.	GROUPS		INDIVIDUALS		TOTAL NO. COUNTS
	Minimum	Maximum	Minimum	Maximum	
1	000	12,000	000	18,000	6
	000	3,000	000	3,000	
2–4	165,000	306,000	258,000	585,000	18
	189,000	315,000	333,000	552,000	
5–7	348,000	765,000	647,000	1,641,000	18
	417,000	627,000	762,000	1,116,000	
8–10	740,000	1,623,000	1,506,000	2,658,000	18
	703,000	1,477,000	1,428,000	2,586,000	

The largest of these variations were evidently caused by differences in counting rather than in differences in smears as some of the widest of them occurred in the recounts of the same smears by different persons.

Dilution counts

As was to be expected, the dilution counts gave results which corresponded in a general way with those obtained by the other methods.

Comparison of plate and microscopic counts

It is only when the plate and microscopic counts are compared that the most important conclusions can be drawn. When the final averages were computed it was found that these counts met all of the checks and counter checks which had been placed upon them, in a remarkable way. Samples 2 to 4 gave average plate and microscopic counts slightly less than one-half of those from samples 5 to 7 and likewise slightly less than one-fourth of those from samples 8 to 10. Samples 5 to 7 gave plate and microscopic counts slightly less than one-half of those from samples 8 to 10 (see table 4.) The group count met this check the most perfectly of any of the three counts, while the plate counts and individual counts met it about equally well. For some reason which is not evident, the counts made on samples 2 to 4 were proportionately the largest in all cases. The average plate counts were always in excess of the group counts and less than the individual counts, as would be the case if the conditions were as postulated; namely a milk containing living organisms, with but small groups and all of the organisms capable of growth on the agar at the incubation temperature used.

In view of these facts, it can scarcely be doubted that we have here for the first time, adequate proof that the mechanical perfection of both the plate method and the microscopic method is sufficient to produce reasonably accurate results in the hands of experienced men, provided the nature and the distribution of the bacteria in the samples of milk is such that accurate counting is possible.

CONCLUSIONS

1. Research men, using technique which differs much in details, may be depended upon to secure much more consistent agar plate counts from ordinary samples of market milk than laboratory assistants working rapidly and using the routine methods of analysis recommended for the purpose.

2. Inexperienced workers are apt to make gross errors in count when using the direct microscopic method as a means of

making exact counts. Experienced workers however secure results which compare favorably with those secured by workers who have had experience with the plating technique.

3. The labor and time necessary in order to make relatively accurate counts by either method is much greater than that ordinarily employed in making counts in laboratories where large numbers of routine analyses are made.

4. In making comparative counts with the plate and microscopic methods, the agar plate counts will normally be larger than the counts of groups of bacteria by the microscopic method and smaller than the count of individual bacteria; but many things may change this relationship in individual cases. Among these things are inaccuracies in the counts due to exceptionally irregular distribution, the presence of dead bacteria or of living bacteria incapable of growth on the agar used.

5. Where a milk contains nothing but living bacteria occurring singly, (or at least with only a relatively small number of groups containing two or more individuals) all of which are capable of growth on the agar used, very consistent counts can be made by either method from duplicate samples by the same or by different persons. In such cases the relation between the counts is such as to leave little doubt but that the figures obtained are remarkably accurate counts of the number of groups of bacteria in the case of both the microscopic and plate method; or of the number of bacteria present in the case of the microscopic method.

REPORT OF COMMITTEE ON RELATIONS TO BREED ASSOCIATIONS

Since our last report official testing has continued to grow at a constantly increasing rate. The problem of handling it in the future is a serious one for the agricultural colleges. The committee is pleased to report a marked improvement in the methods of conducting of official tests as a result of the efforts of this committee and this association to standardize official testing and to stimulate those responsible for its administration in the several states to more carefully supervise and safeguard the work.

Apparently most of the states, especially where a considerable amount of testing is done, on the whole, have the situation well in hand. In a few states, from the information at hand, the present management of official testing reflects no credit on the man and institution responsible, and certainly does not add to the professional standing of teachers and investigators in agricultural lines.

The practical man will not have much respect for an institution that tests his cows three days, then allows him to select and report the two best days, or if he is allowed to milk cows on two sides of a barn at the same time, or if the tester has the milker take samples. Authenticating the records of a cow test association when the college has no control whatever of the tester may please the breeder concerned but certainly does not increase the prestige of the college or experimental station. All these practices and some others have come to the attention of members of the committee.

In May, 1916, the chairman of the committee sent a questionnaire to the superintendent of official testing in each state asking:

1. If the rules for the supervision of official testing as adopted by the Dairy Instructors' Association are followed.

2. If the recommendations of the association regarding the number of cows a tester is allowed to test at a time is followed.

3. If records of cow test associations are authenticated.

The replies showed that the rules for the supervision of tests as adopted by the association are followed in detail by nineteen states including most of those where the largest amount of testing is done. Four others follow the rules with the exception that the composite sample is omitted and five others follow the Breed Association rules concerning preliminary milkings. Nine states follow the rules of the breed associations without regard to the recommendations of the Dairy Instructors' Association.

Concerning the authentication of cow test association records no uniform practice as yet exists. The majority of the states are doing more or less of it although the testers are generally appointed by the Agricultural College. It should be said, however, that most of the states doing a large amount of official testing; namely, New York, Illinois, Wisconsin, Michigan, Pennsylvania, Massachusetts, and Indiana, do not authenticate such records.

The replies to the third inquiry show that in most states the number of cows the tester is allowed to test is limited to that recommended by the association, or to a number substantially the same. In some cases the number allowed seems entirely too high. A report has come to the committee that in one state a tester has been allowed to test as many as fifty cows in one day.

The following recommendations were made by the committee and received the approval of the association:

1. That the person in charge of official testing within a state be termed "Superintendent of Official Testing" and the representative of this official who does the testing be termed the "Supervisor" and ask the breed associations to adopt these terms.

2. That the secretary of this association be authorized with the assistance of the chairman of this committee to prepare forthwith a report giving all resolutions and reports on official testing adopted by this association, and further that this mate-

rial be published in pamphlet or mimeograph form at the expense of the association and distributed to all colleges and experiment stations.

3. We ask those dairy breed associations which have not already done so to recognize the rules for official testing as adopted by this association and to include them in their publications.

4. With reference to authenticating records of cow test associations:

It is the sentiment of this body that records supervised by cow testing association employees should not be authenticated unless the supervisor be selected and employed by the Superintendent of Official Testing in that state, and that the work be done in strict accordance with the rules adopted by the Official Dairy Instructors' Association for the conduct of official tests, and further that even in states where cow testing association records are authenticated under these conditions the practice should be discontinued as promptly as more satisfactory arrangements can be made.

This committee further recommends that no person be allowed to act as supervisor in official test work who is not at the time in the employ of, and receiving his directions and compensation from the superintendent of official testing for that state.

5. We ask that the different breed associations recognize only one superintendent of official testing in each state.

Committee,

H. H. WING, Cornell,
E. G. WOODWARD, Neb.,
R. T. HARRIS, Wis.,
G. S. BULKLEY, Pa.,
H. E. VAN NORMAN, Calif.,
C. H. ECKLES, Mo., *Chairman*.

SPECIFICATIONS AND DIRECTIONS FOR TESTING MILK AND CREAM FOR BUTTERFAT

O. F. HUNZIKER

Chairman Committee on Official Methods of Testing Milk and Cream for Butterfat Official Dairy Instructors' Association, 1916

I. APPARATUS AND CHEMICALS

Milk test bottle.—8 per cent 18 gram milk test bottle, graduated to 0.1 percent. Graduation. The total per cent graduation shall be 8. The graduated portion of the neck shall have a length of not less than 63.5 mm. (2½ inches). The graduation shall represent whole per cent, five-tenths per cent and tenths per cent. The tenths per cent graduations shall not be less than 3 mm. in length; the five-tenths per cent graduations shall be 1 mm. longer than the tenths per cent graduations, projecting 1 mm. to the left; the whole per cent graduation shall extend at least one-half way around the neck to the right and projecting 2 mm. to the left of the tenths per cent graduations. Each per cent graduation shall be numbered, the number being placed on the left of the scale.

The maximum error in the total graduation or in any part thereof shall not exceed the volume of the smallest unit of the graduation.

Neck. The neck shall be cylindrical and of uniform internal diameter throughout. The cylindrical part of the neck shall extend at least 5 mm. below the lowest and above the highest graduation mark. The top of the neck shall be flared to a diameter of not less than 10 mm.

Bulb. The capacity of the bulb up to the junction of the neck shall not be less than 45 cc. The shape of the bulb may be either cylindrical or conical with the smallest diameter at the bottom. If cylindrical, the outside diameter shall be be-

tween 34 and 36 mm.; if conical, the outside diameter of the base shall be between 31 and 33 mm., and the maximum diameter between 35 and 37 mm.

The charge of the bottle shall be 18 grams.

The total height of the bottle shall be between 150 and 165 mm. (5⅞ and 6½ inches).

Cream test bottle 1.—50 per cent 9 gram short-neck cream test bottle, graduated to 0.5 per cent. Graduation—The total per cent graduation shall be 50. The graduated portion of the neck shall have a length of not less than 63.5 mm. (2½ inches). The graduation shall represent 5 per cent, 1 per cent, and 0.5 per cent. The 5 per cent graduations shall extend at least half-way around the neck (to the right). The 0.5 per cent graduations shall be at least 3 mm. in length, and the 1 per cent graduations shall have a length intermediate between the 5 per cent and the 0.5 per cent graduations. Each 5 per cent graduation shall be numbered, the number being placed on the left of the scale.

The maximum error in the total graduation or in any part thereof shall not exceed the volume of the smallest unit of the graduation.

Neck. The neck shall be cylindrical and of uniform internal diameter throughout. The cylindrical part of the neck shall extend at least 5 mm. below the lowest and above the highest graduation mark. The top of the neck shall be flared to a diameter of not less than 10 mm.

Bulb. The capacity of the bulb up to the junction of the neck shall not be less than 45 cc. The shape of the bulb may be either cylindrical or conical with the smallest diameter at the bottom. If cylindrical, the outside diameter shall be between 34 and 36 mm.; if conical, the outside diameter of the base shall be between 31 and 33 mm. and the maximum diameter between 35 and 37 mm.

The charge of the bottle shall be 9 grams. All bottles shall bear on top of the neck above the graduations, in plainly legible characters, a mark defining the weight of the charge to be used (9 grams).

The total height of the bottle shall be between 150 and 165 mm. ($5\frac{7}{8}$ and $6\frac{1}{2}$ inches), same as standard milk test bottles.

Cream test bottle 2.—50 per cent 9 gram long-neck cream test bottle, graduated to 0.5 per cent. The same specifications in every detail as specified for the 50 per cent 9 gram short-neck bottle shall apply for the long-neck bottle with the exception, however, that the total height of this bottle shall be between 210 and 235 mm. ($8\frac{1}{4}$ and 9 inches), that the total length of the graduation shall be not less than 120 mm., and that the maximum error in the total graduation or in any part thereof shall not exceed 50 per cent of the volume of the smallest unit of the graduation.

Cream test bottle 3.—50 per cent 18 gram long-neck cream test bottle, graduated to 0.5 per cent. The same specifications in every detail as specified for the 50 per cent 9 gram long-neck bottle shall also apply for the 18 gram long-neck bottle, except that the charge of the bottle shall be 18 grams. All bottles shall bear on top of the neck above the graduation, in plainly legible characters, a mark defining the weight of the charge to be used (18 grams).

Pipette, capacity, 17.6 cc. Total length of pipette not more than 330 mm. ($13\frac{1}{4}$ inches). Outside diameter of suction tube 6 to 8 mm. Length of suction tube 130 mm. Outside diammeter of delivery tube 4.5 to 5.5 mm. Length of delivery tube 100 to 120 mm. Distance of graduation mark above bulb 15 to 45 mm. Nozzle straight. To deliver its contents when filled to the mark with water at 20°C., in five to eight seconds. The maximum error shall not exceed 0.05 cc.

Acid measure, capacity 17.5 cc.

Cream testing scales. Sensibility reciprocal of 30 mgm., i.e., the addition of 30 mgm. to the scales, when loaded to capacity, shall cause a deflection of the pointer of at least one division on the graduation.

Weights, 9 gram weights for 9 gram cream test bottles and 18 gram weights for 18 gram cream test bottles, preferably stamped correct by the United States or State Bureau of Standards.

Tester. Standard Babcock test centrifuge and speed indicator.

Dividers for measuring fat column.

Water bath for cream samples, with proper arrangement for regulating and recording temperature of samples.

Water bath for test bottles, of sufficient size and with necessary equipment to insure proper control of temperature. The following dimensions for a twenty-four bottle water bath are recommended: Metal box, 14 inches long, 11 inches wide and 8½ inches deep and equipped with a bottle basket 9½ inches long and 6½ inches wide, capacity twenty-four bottles, a steam and water inlet, a drain, a thermometer holder with thermometer.

Chemicals. Commercial sulphuric acid, specific gravity 1.82 to 1.83; glymol, or white mineral oil, high grade.

II. MANIPULATION OF TEST

A. Milk Test

Milk Samples. Single samples are preferred to composite samples. If composite samples are used they should be kept in clean jars sealed air-tight, and containing a sufficient amount of preservative. Corrosive sublimate, potassium bichromate and formaldehyde may be used as satisfactory preservatives. For the keeping of composite samples a cool location should be chosen. They should be the product of not over one week and should be tested as soon as possible.

If transported by mail, express or otherwise the sample bottle should be completely full and tightly stoppered and the samples should be preserved as above directed.

Immediately before testing the sample is thoroughly mixed until it is homogeneous. If lumps of cream, butter or ice do not completely disappear, heat to 100° to 120°F., mix thoroughly and pipette at once. Avoid incorporation of air bubbles while mixing the sample. Curdy and churned samples are not dependable.

Testing. Measure 18 grams of milk from properly mixed sample into standard milk test bottle, by using 17.6 cc. standard pipette; add 17.5 cc. of standard commercial sulphuric acid,

and shake until all curd has disappeared, and then continue the shaking for a few moments longer. Milk and acid before mixing should have a temperature of 50° to 70°F.

Whirl in Babcock centrifuge for five, two and one minutes, respectively, filling the bottle with hot soft water (temperature 140°F. or above) to the bottom of the neck after the first whirling and to near top graduation after the second whirling. The proper speed of the centrifuge is 800 revolutions for an 18 inch diameter wheel and 1000 revolutions per minute for a 12 inch diameter wheel.

Set the test bottles into water bath and read after a temperature of 135°F. to 140°F. has been maintained for not less than 3 minutes. Read test by measuring fat column from bottom of lower meniscus to top of upper meniscus. Use dividers for reading.

B. Cream Test

Cream Samples. Cream samples should be tested as soon as possible and not later than three days after they are taken. Composite samples representing portions of consecutive deliveries of the same patron are unreliable. Samples should at all times be kept in nonabsorptive containers, sealed air-tight and held in the cold.

Immediately before testing mix the sample until it pours readily and a uniform emulsion is secured. If in good condition shake, pour or stir until properly mixed. If very thick, warm to 85°F. and then mix. In case of lumps of butter heat the sample to 100°F. to 120°F. by setting in water bath, mix thoroughly and weigh out at once. For commercial work on a large scale it is advisable to temper all samples to 100° to 120°F. in a water bath previous to mixing. Great care should be exercised to avoid overheating the sample, causing the cream to "oil off." This precaution is especially necessary with thin cream.

Testing. Weigh 9 grams or 18 grams, respectively, of the properly mixed sample into a standard cream test bottle on standard cream testing scales which are in proper working condition, set level and are protected from drafts.

Method I. Add standard commercial sulphuric acid until the mixture of acid and cream, immediately after shaking, resembles in color, coffee with cream in it. Usually about 8 to 12 cc. of acid is required in the case of the 9 gram bottle or 14 to 17 cc. of acid in the case of the 18 gram bottle, the amount needed depending on the temperature of acid and cream and on the richness of the cream.

Whirl in Standard Babcock centrifuge at proper speed, five, two and one minutes, respectively, filling the bottles with hot soft water, temperature 140 F. or above, to the bottom of the neck after the first whirling and to near the top graduation after the second whirling.

a. Alternate Method. Add 9 cc. of water after the cream has been weighed into the test bottle and before the acid is added, then add 17.5 cc. acid and proceed as in previous method. This method is applicable with the 9 gram bottle only.

b. Alternate Method. Add 8 to 12 cc. of acid in the case of the 9 gram bottle or 14 to 17 cc. of acid in the case of the 18 gram bottle, or add acid until the mixture of cream and acid, after shaking, has a chocolate brown color. After the cream and acid have been thoroughly mixed and all lumps have completely disappeared, add a few cubic centimeters (not less than 5 cc.) of hot soft water, whirl five minutes, add hot soft water to near top of scale and whirl one minute.

The proper speed of the centrifuge is 800 revolutions per minute for an 18 inch diameter wheel and 1000 revolutions per minute for a 12 inch diameter wheel.

Set the test bottles into water bath and read after a temperature of 135°F. to 140°F. has been maintained for not less than three minutes, add a few drops of glymol and read at once, preferably using dividers. Experienced testers are able to secure correct readings without glymol by reading to the bottom of the upper meniscus but the use of glymol is urged.

C. Defective Tests

The fat column of the finished test should be clear, translucent and should have a golden yellow to amber color. All

tests which are milky, or foggy, or showing the presence of curd or charred matter in or below the fat column, or of which the reading is indistinct or uncertain, should be rejected. Duplicate tests are essential in all work where special accuracy of results is required, such as in official testing and experimental investigations.

REPORT OF THE COMMITTEE ON STATISTICS OF MILK AND CREAM REGULATIONS OF THE OFFICIAL DAIRY INSTRUCTORS' ASSOCIATION

PRESENTED AT ITS MEETING AT SPRINGFIELD, MASSACHUSETTS, OCTOBER 17, 1916

Committee: Mr. Ivan C. Weld, *Chairman*: Prof. E. H. Farrington, University of Wisconsin; Mr. J. A. Gamble, Dairy Division, U. S. Department of Agriculture; Prof. H. E. Ross, Cornell University; Mr. Roy C. Potts, Bureau of Markets, U. S. Department of Agriculture

In taking up a study of the milk and cream regulations of the cities and towns of the United States, the committee decided upon a classification of the cities into four groups according to their population, as follows:

Group I	5,000 to 25,000 population
Group II	25,000 to 100,000 population
Group III	100,000 to 500,000 population
Group IV	Over 500,000 population

The survey includes 194 headings and sub-headings pertaining to laws and ordinances designed to regulate the production, care and sale of milk and cream, and presents and includes a mass of statistics that we hope may be carefully studied by all members of this Association and by others.

The handling of milk supplies during milk-borne epidemics has not been included in this survey.

In compiling these data, the committee has held strictly to the exact wording in the regulations covered and has made no note of matter implied but not specifically stated.

The committee is indebted to the Market Milk Section of the Dairy Division of the Bureau of Animal Industry for the opportunity to study the milk regulations of 694 cities now on file in that office. Some of these city regulations were adopted recently. Others were adopted several years ago.

The committee is also indebted to the Department of Agriculture for much of the clerical assistance necessary for compiling the data.

Your committee has endeavored to compile the data as systematically as possible, and in a way that will make possible a comparison of the requirements of cities within a single group, and requirements of cities of one group with requirements of cities of other groups.

Complete regulations were obtained from 409 of the 694 cities represented in our study; from 62, partially complete regulations were obtained; and 223 cities reported they had no regulations pertaining to the sale of milk and cream. An exceedingly large proportion, or 218, of the cities having no regulations governing the sale of milk and cream were in the group containing from 5,000 to 25,000 population. These cities were located in 45 states, so may be considered as representative of the whole country.

Information in detail is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of cities and towns represented in this survey	511	133	42	8	694
Number of cities and towns reporting no regulations	218	5	0	0	223
Number of cities and towns from which partial regulations were available	59	3	0	0	62
Number of complete regulations of cities and towns represented	234	125	42	8	409

PERMITS OR LICENSES

The survey shows that over half of the cities require licenses, or permits, for the sale of milk, and of these about one-third do not require the inspection of the dairy or city milk plant before

granting the license. In practically all of the cities permits or licenses are issued annually. The basis of charge for permits or licenses varies greatly, some charging a certain sum per annum, others a certain sum per wagon, others a certain sum per cow, and one city charges a certain sum for each thousand pounds of milk handled. The more common practice is to charge a specified sum per annum. This amount varies from 25 cents to $10.00 per annum. In other cities the rate varies from 50 cents to $10.00 per wagon, and from $1.00 per 15,000 pounds of milk sold per month to $20.00 per month where over 320,000 pounds of milk is sold.

Information in detail is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of cities requiring licenses or permits for the sale of milk	207	105	37	8	357
Number of regulations failing to mention permits or requiring none	27	20	5	0	52
Number of regulations which state that permits are issued					
Annually	154	85	20	4	263
Semi-annually	7	4	3	0	14
Each three months	1	0	0	0	1
Monthly	0	1	0	0	1
Number of regulations which fail to state how how often permits are issued	72	15	14	4	105
Charges for permits or licenses					
Number of cities requiring fees	106	50	15	2	173
Number of cities not reporting or not requiring fees	128	75	27	6	236

Charges for permits or licenses—Continued

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of cities charging					
$3.00 per month	1	0	0	0	1
1.00 per six months	1	0	0	0	1
0.25 annually	0	2	0	0	2
0.50 annually	20	7	2	0	29
1.00 annually	21	10	1	1	33
1.50 annually	1	0	0	0	1
2.00 annually	23	2	1	0	26
3.00 annually	1	1	0	0	2
5.00 annually	7	3	0	0	10
10.00 annually	3	2	0	0	5
0.50 per wagon annually	0	1	0	0	1
1.00 per wagon annually	1	4	1	0	6
2.00 per wagon annually	3	2	0	0	5
2.50 per wagon annually	0	1	0	0	1
5.00 per wagon annually	2	2	2	0	6
10.00 per wagon annually	2	0	0	1	3
$0.50 per wagon; $1.00 each additional wagon, annually	1	0	0	0	1
$1.00 each wagon; $0.25 each additional wagon, annually	1	0	0	0	1
$1.00 each wagon; $1.00 each plant, annually	1	0	0	0	1
$1.00 each wagon; $0.50 license	0	1	0	0	1
$1.00 each wagon; $1.00 license	0	0	1	0	1
$1.00 each wagon; plant and store	0	2	0	0	2
$1.50 1st wagon; $1.00 2d; $0.75 3d; $0.50 4th	1	0	0	0	1
$2.00 1st wagon; $0.50 each additional wagon	1	1	0	0	2
$2.00 per wagon each 6 months; $0.50 each additional wagon	1	0	0	0	1
$2.00 1st wagon; $1.00 each additional wagon	1	0	0	0	1
$2.00 per wagon; $1.00 each store	0	1	2	0	3
$2.00 per wagon; $2.00 additional wagon	0	0	1	0	1
$2.00 per wagon; $3.00 permit	0	0	1	0	1
$2.00 per wagon; $2.00 per cow; $5.00 license	0	1	0	0	1

Charges for permits or licenses—Continued

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of cities charging					
$2.50 per wagon; $1.00 pushcart; $0.50 hand carried	1	0	0	0	1
$2.50 per wagon; $0.50 pushcart; $0.50 can carried; $1.00 store; $5.00 each place	0	1	1	0	2
$3.00 per wagon; $1.00 each store; 1 to 5 cows, $0.25; 6 to 10 cows, $0.50; above 10 cows, $1.00	0	1	0	0	1
$5.00 per wagon; $2.00 each additional wagon	1	0	0	0	1
$5.00 per wagon; $2.00 cart; $1.00 carried	0	0	1	0	1
$10.00 each wagon; $2.00 per dairy; $10.00 each place of business	0	1	0	0	1
$10.00 1st wagon; $10.00 additional wagons; $1.00 each cow 1–10 cows; $5.00 less than 10 gal. milk	0	0	1	0	1
$0.25 per cow	1	0	0	0	1
.50 per cow	1	0	0	0	1
.75 per cow	1	0	0	0	1
1.00 per cow	2	1	0	0	3
$0.50 per cow; $0.10 each additional cow	1	0	0	0	1
$1.00 per cow, 1–10 cows; $0.50 per cow over 10	3	0	0	0	3
$0.50 per cow, 1–5 cows; $0.40 per cow, 6–10 cows; $0.30 per cow, 11–20 cows; $0.20 per cow, 21–50 cows; $0.10 per cow, 51–100 cows; $0.05 each cow above 100	0	1	0	0	1
$0.50 1 cow; $1.00 2 cows; $1.50 3 cows; $2.00 4 and above	1	0	0	0	1
$0.50 per cow; $2.00 place of business	0	1	0	0	1
$1.00, 1–3 cows; $0.50 each additional cow; $10.00 for license	1	0	0	0	1
Selling 15,000 lbs. milk per month, $1.00 per month; 15,000–40,000 lbs., $2.00 per month; 40,000–80,000 lbs., $4.00 per month; 80,000–160,000 lbs., $8.00 per month; 160,000–240,000 lbs., $12.00 per month; 240,000–320,000 lbs., $15.00 per month; above 320,000 lbs., $20.00 per month	0	1	0	0	1

Charges for permits or licenses—Concluded

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of cities which require inspection of plant and dairies before granting licenses	69	35	20	2	126
Number of cities requiring no inspection of dairies and plants	165	90	22	6	283
Number of cities specifying that a license be secured for each place of business	0	0	4	2	6
Number of cities not specifying this	234	125	38	6	403

CHEMICAL COMPOSITION

Legal limits for composition of milk and cream vary greatly. The regulations of about four-tenths of the cities specify legal limits for water content. Of those cities specifying a limit for water, we found the amount permitted to vary from 80 per cent to 89 per cent, one city having incorporated in its ordinance the following: "Milk shall not contain more than 80 per cent water." The majority of the cities permit a maximum water content of 88 per cent.

Less than one-half of the cities have a requirement for a minimum percentage of total solids. The amount of total solids required varies from 10.5 per cent to 13 per cent. Three-fifths of the cities have an established minimum of 12 per cent for total solids.

Approximately one-fourth of the cities have an established requirement for a minimum percentage of solids not fat. The required amount of solids not fat varies from 8 per cent to 10.5 per cent, with nearly six-sevenths of the cities having a minimum requirement of 8.5 per cent.

A requirement for a minimum percentage of fat in milk has been established by approximately five-eighths of the cities. The amount of fat required varies from 2.5 per cent to 4 per cent. Three-tenths of the cities require not less than 3 per cent fat, and one-tenth require not less than 3.25 per cent. Over half

of the cities have established as the legal minimum 3.5 per cent of fat or less. Practically the same number of cities which have established a minimum percentage for fat in milk have also established a minimum percentage for fat in cream. Approximately one-half of the cities require not less than 18 per cent fat. About one-eighth of the cities require not less than 20 per cent fat. One-eighth require 16 per cent fat, and one-eighth require 15 per cent fat. It will be observed that in the matter of chemical composition there is a very great variation in the requirements, and milk or cream that may be legally sold in one city may not be so sold elsewhere. The detailed information is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations limiting percentage of water	79	53	21	7	160
Number of regulations not referring to percentage of water	155	72	21	1	249
Number of regulations limiting water content of milk to					
89.00 per cent	1	0	1	0	2
88.51 per cent	0	11	0	0	11
88.50 per cent	3	0	2	2	7
88.25 per cent	2	2	1	0	5
88.00 per cent	44	29	12	4	89
87.51 per cent	1	2	0	0	3
87.50 per cent	12	4	3	1	20
87.05 per cent	0	1	0	0	1
87.00 per cent	12	3	2	0	17
80.50 per cent	1	0	0	0	1
80.00 per cent	2	1	0	0	3
8.00 per cent	1	0	0	0	1
Total solids					
Number of regulations requiring a minimum percentage of total solids	106	60	25	7	198
Number of regulations not referring to percentage of total solids	128	65	17	1	211

Total solids—Continued

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations having or calling for					
13.00 per cent total solids	13	2	2	0	17
12.51 per cent total solids	2	2	1	0	5
12.50 per cent total solids	15	1	3	1	20
12.15 per cent total solids	6	2	0	0	8
12.00 per cent total solids	59	46	15	4	124
11.75 per cent total solids	2	2	1	0	5
11.50 per cent total solids	7	5	3	2	17
11.00 per cent total solids	1	0	0	0	1
10.50 per cent total solids	1	0	0	0	1
Solids not fat					
Number of regulations calling for minimum percentage of solids not fat	38	24	16	1	79
Number of regulations not referring to percentage of solids not fat	198	103	26	7	334
Number of regulations calling for					
10.50 per cent solids not fat	0	1	0	0	1
9.50 per cent solids not fat	1	1	0	0	2
9.25 per cent solids not fat	0	1	0	0	1
9.00 per cent solids not fat	6	2	1	0	9
8.75 per cent solids not fat	1	2	4	0	7
8.50 per cent solids not fat	28	14	11	1	54
8.25 per cent solids not fat	0	1	0	0	1
8.00 per cent solids not fat	2	2	0	0	4
Fat in milk					
Number of regulations requiring a minimum percentage of fat	137	81	32	7	257
Number of regulations not referring to percentage of fat	97	44	10	1	152
Number of regulations calling for					
4.00 per cent fat	0	0	1	0	1
3.70 per cent fat	2	0	0	0	2
3.60 per cent fat	2	1	1	0	4
3 51 per cent fat	0	1	1	0	2
3.50 per cent fat	35	10	7	1	53
3.40 per cent fat	3	1	1	0	5
3.35 per cent fat	8	2	0	0	10

Fat in milk—Continued

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations calling for					
3.30 per cent fat	0	1	0	0	1
3.25 per cent fat	20	19	6	1	46
3.20 per cent fat	0	2	2	0	4
3.00 per cent fat	67	43	12	5	127
2.50 per cent fat	0	1	1	0	2

Fat in cream

Number of regulations requiring a minimum percentage of fat	87	49	20	5	161
Number of regulations not referring to percentage of fat	147	76	22	3	248
Number of regulations calling for					
25.0 per cent fat	3	1	0	0	4
22.0 per cent fat	1	0	0	0	1
20.0 per cent fat	13	3	5	0	21
19.0 per cent fat	1	0	0	0	1
18.0 per cent fat	42	29	12	2	85
17.5 per cent fat	1	0	0	0	1
16.0 per cent fat	10	6	3	0	19
15.0 per cent fat	13	10	0	3	26
14.0 per cent fat	2	0	0	0	2
10.0 per cent fat	1	0	0	0	1

Samples

Number of regulations in which the amount of the sample to be taken was stated	15	8	9	0	32
Number of regulations in which the amount of sample to be taken was not stated	229	117	33	8	387
Number of regulations calling for quart samples	11	1	7	0	19
1 pint	3	4	2	0	9
½ pint	0	2	0	0	2
¼ pint	1	1	0	0	2

BACTERIA

Less than one-half the cities have regulations relating to the number of bacteria in milk. The requirements of cities providing a numerical limit for bacteria in milk range from a permitted maximum of 50,000 bacteria per cubic centimeter to a permitted maximum of 5,000,000 bacteria per cubic centimeter. Approximately one-half of these cities have established a numerical limit of 500,000 bacteria per cubic centimeter as the greatest number that may be legally contained in milk that is offered for sale. About one-sixth of the cities have established a legal numerical limit of between 250,000 and 300,000 bacteria per cubic centimeter. One-sixth of the cities forbid the sale of milk having over 100,000 bacteria per cubic centimeter.

About one-eleventh of the cities have established bacterial limits for cream, and the number of organisms legally permitted in one cubic centimeter varies from 50,000 to 1,000,000. One-third of these cities specify 500,000 as the legal maximum number, one-third 1,000,000 as the legal maximum number, and the others, with one exception, require somewhat less than 500,000 bacteria per cubic centimeter in cream. The detailed information is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations having a legal limit for bacteria in milk	95	66	24	4	189
Number of regulations not referring to bacterial limits	139	59	18	4	220
Number of regulations having a numerical limit for bacteria of					
50,000 per cubic centimeter	1	1	0	0	2
100,000 per cubic centimeter	21	11	3	0	35
150,000 per cubic centimeter	1	3	1	0	5
200,000 per cubic centimeter	6	7	4	0	17
250,000 per cubic centimeter	7	4	2	0	13
300,000 per cubic centimeter	7	10	2	0	19
350,000 per cubic centimeter	0	0	0	0	0

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations having a numerical limit for bacteria of:					
400,000 per cubic centimeter	1	1	1	0	3
500,000 per cubic centimeter	49	27	11	2	89
1,000,000 per cubic centimeter	2	2	0	1	5
5,000,000 per cubic centimeter	0	0	0	1	1
Number of regulations having a legal limit for bacteria in cream	7	15	8	0	30
Number of regulations not referring to bacterial limits in cream	227	110	34	8	379
Number of regulations having a numerical limit for bacteria of					
50,000 per cubic centimeter	1	0	0	0	1
100,000 per cubic centimeter	0	1	0	0	1
150,000 per cubic centimeter	0	1	0	0	1
200,000 per cubic centimeter	1	1	0	0	2
250,000 per cubic centimeter	0	0	0	0	0
300,000 per cubic centimeter	0	1	2	0	3
350,000 per cubic centimeter	0	1	0	0	1
500,000 per cubic centimeter	1	4	5	0	10
800,000 per cubic centimeter	1	0	0	0	1
1,000,000 per cubic centimeter	3	6	1	0	10

TEMPERATURE

Approximately five-eighths of the cities have established maximum temperature limits for milk. About one-half of these cities have fixed 50° F. as the highest legal temperature for milk at the farm; nearly one-third of these cities have fixed 60° F. as the highest legal temperature for milk at the farm. A few permit temperatures as high as 70° F., while others require temperatures not higher than 45° F. In about one-half the cities regulations fixing the maximum temperatures permitted for milk on common carriers have been provided. About one-half of these have prohibited a temperature higher than 50° F., and about one-fourth prohibit a temperature higher that 60° F. Other cities require temperatures not higher than 45° F., and some permit temperatures as high as 77° F. The temperatures of milk re-

quired at time of delivery are essentially the same as those required under transportation. The detailed information is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations having a legal temperature limit for milk at farm	131	86	30	4	251
Number of regulations not having a legal temperature limit for milk at farm	103	39	12	4	158
Number of regulations calling for a temperature not higher than					
77° F.	1	0	0	0	1
70° F.	2	1	1	0	4
65° F.	4	3	2	0	9
60° F.	42	19	8	1	70
58° F.	2	3	1	0	6
55° F.	11	14	1	1	27
50° F.	67	45	16	1	129
45° F.	2	1	1	1	5
Number of regulations prescribing temperature for milk on common carriers	95	75	27	4	201
Number of regulations not prescribing temperature for milk on common carriers	139	50	15	4	208
Number of regulations calling for a temperature not higher than					
77° F.	1	0	0	0	1
70° F.	1	2	2	0	5
65° F.	6	1	1	0	8
63° F.	0	2	0	0	2
60° F.	26	21	10	1	58
58° F.	0	1	0	0	1
55° F.	11	12	1	1	25
50° F.	49	36	13	2	100
45° F.	1	0	0	0	1
Number of regulations prescribing for milk in city temperature	95	74	32	7	208
Number of regulations not prescribing or stating temperature of milk in city	139	51	10	1	201
Number of regulations calling for a temperature not higher than					
77° F.	1	0	0	0	1
70° F.	1	2	2	0	5

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations calling for a temperature not higher than					
65° F.	6	1	2	0	9
63° F.	0	2	0	0	2
60° F.	27	19	11	1	58
58° F.	0	1	0	0	1
56° F.	1	0	0	0	1
55° F.	12	13	2	0	27
50° F.	46	36	15	5	102
45° F.	1	0	0	1	2

SPECIFIC GRAVITY

Only 38 cities have established a minimum for specific gravity of milk. Of these, 25 state 1.029 as the minimum. The requirements of the other cities range from 1.027 to 1.033. (The regulation of one city calls for milk of a specific gravity of 10.29, another requires a specific gravity of 1030.0, and another a specific gravity of 1029.0!)

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations prescribing a minimum specific gravity	0	31	7	0	38
Number of regulations requiring a specific gravity of					
1030.0	0	2	0	0	2
1029.0	0	4	0	0	4
10.29	0	2	0	0	2
1.030	0	1	1	0	2
1.029–1.033	0	0	3	0	3
1.029	0	20	3	0	23
1.028	0	1	0	0	1
1.027	0	1	0	0	1

CONDITIONS WHICH RENDER MILK UNSALABLE

Three hundred and ninety-six cities forbid the sale of milk produced or handled under certain stated conditions.

Two hundred and eighty-seven declare milk unsalable when cows are diseased; 115 when cows are kept in filthy quarters; 82 when the milk contains visible dirt; 144 when cows are kept in crowded and unhealthy stables; 260 when milk is adulterated; 205 when milk contains foreign substance. There are in all about 58 conditions which render milk legally unsalable and which are included in one or more city ordinances. Some of the prohibited foods for milch cows are as follows: Swill, distillers' grains, garbage, vinegar waste, turnips, cabbage, garlic; and one prohibits feeding the cows on silage. Another regulation states: "No person shall sell, deliver, etc., 'Milk drawn from cows fed in whole or in part on green corn or silage, unless the person so selling or delivering shall first inform the person to whom it is sold or delivered of the nature of the milk so sold or delivered.'" Another regulation states: "No milk shall be sold from cows fed corn stalks before the corn has blossomed." And still another regulation provides that "Milk is unsalable when produced in stables containing cattle or other animals."

The conditions in detail which render milk legally unsalable in these cities are as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations which forbid the sale of milk under conditions stated below	234	115	39	8	396
Number of regulations which do not mention when milk is unsalable	0	10	3	0	13
Number of regulations which mention					
Diseased cows	160	85	34	8	287
Cows kept in filthy quarters	67	36	12	0	115
Milk containing visible dirt	46	29	6	1	82
Cows kept in crowded and unhealthy stable	79	43	20	2	144

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations which mention					
Milk when adulterated	150	77	30	3	260
When cows are fed distillers' grains	59	42	17	7	125
When cows are fed swill	58	41	14	3	116
From cows a certain number of days before calving	139	86	27	6	258
From cows a certain number of days after calving	138	89	27	6	260
Foreign substance in milk	107	65	28	5	205
Putrefactive feeds	57	38	21	4	120
Feeds unwholesome	73	50	22	0	145
Feeds impure	47	38	10	0	95
Milk unclean	23	16	5	0	44
Cows fed on refuse	41	28	9	2	80
Cows fed garbage	34	34	13	3	84
Cows fed wet brewers' grains	32	22	12	2	68
Cows given contaminated water	19	10	18	3	50
Cows fed vinegar waste	6	6	6	0	18
Pus in milk	8	4	1	0	13
Cows fed beet pulp	5	1	0	0	6
Cows fed turnips	2	2	0	0	4
Cows fed starch waste	8	4	0	0	12
Diseased cows	1	2	0	0	3
Insanitary foods	1	0	0	0	1
Frozen foods	1	0	0	0	1
Ropy milk	8	6	0	0	14
Bloody milk	14	11	4	1	30
Milk above legal limits in bacteria	94	18	0	0	112
Milk above legal limits in temperature	139	44	2	0	185
Improper milk	2	4	3	0	9
Watered	1	0	0	0	1
Diluted	3	0	0	0	3
Silage	1	1	0	0	2
Unsound	1	0	0	0	1
Tainted	1	1	1	0	3
Musty	1	0	0	0	1
Insects	1	0	0	0	1
Hairs	1	0	0	0	1
Flies	1	0	0	0	1

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations which mention					
Sediment	1	0	1	0	2
Sour	1	0	0	0	1
Sophisticated	1	0	0	0	1
Mouldy	1	2	0	0	3
Decayed	3	0	0	0	3
Acid plus 2	1	6	1	0	8
Garget	1	0	0	0	1
Abnormal	3	0	0	0	3
Unnatural	0	1	2	0	3
Bitter	0	1	0	0	1
Decomposed	0	1	0	0	1
Glucose	0	3	0	0	3
Garlic	0	1	0	0	1
Unhealthy	0	9	4	0	13
Stringy	0	2	2	0	4
Cabbage	0	2	0	0	2
Slimy	0	0	2	1	3
Sugar waste	0	0	1	0	1

PARTURITION

The regulations in regard to parturition vary greatly. Four cities prohibit the sale of milk 60 days before parturition, and one city permits the sale of milk up to 4 days before parturition. One city prohibits the sale of milk sooner than 21 days after parturition, and one city permits the sale of milk as soon as 3 days after. 235 of the 261 cities having regulations on this subject prohibit the sale of milk from 15 to 30 days before parturition, and 244 of the 261 cities prohibit the sale of milk from 5 to 12 days after parturition. Detailed information is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations providing for a specific number of days before and after parturition that the milk cannot be used	139	89	27	6	261
Number of regulations which do not cover this point	95	36	15	2	148
Number of regulations prohibiting the sale of milk					
60 days before parturition	4	0	0	0	4
45 days before parturition	1	0	0	0	1
42 days before parturition	0	1	0	0	1
40 days before parturition	0	1	0	0	1
30 days before parturition	19	3	1	0	23
21 days before parturition	6	5	0	0	11
20 days before parturition	11	7	3	0	21
15 days before parturition	89	63	23	5	180
14 days before parturition	4	1	0	0	5
12 days before parturition	0	1	0	0	1
10 days before parturition	1	2	0	1	4
8 days before parturition	4	1	0	0	5
4 days before parturition	0	1	0	0	1
Number of regulations prohibiting the sale of milk					
21 days after parturition	1	0	0	0	1
15 days after parturition	5	3	1	0	9
12 days after parturition	7	7	3	0	17
10 days after parturition	28	12	5	1	46
9 days after parturition	3	2	0	0	5
8 days after parturition	4	0	1	0	5
7 days after parturition	10	8	2	1	21
6 days after parturition	4	3	2	1	10
5 days after parturition	72	52	13	3	140
4 days after parturition	3	2	0	0	5
3 days after parturition	1	0	0	0	1

TUBERCULIN TESTING OF COWS

Ninety-eight cities require the tuberculin testing of cows, and 50 of these 98 cities require the cows to be tuberculin tested yearly. Three cities require cows to be tuberculin tested once in

two years. One city requires cows to be tuberculin tested twice a year, and one city requires that cows be tuberculin tested at the discretion of the inspector.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations specifying that cows					
Be tuberculin tested	53	21	21	3	98
Be tested once a year	20	16	14	0	50
Be tested once in two years	2	1	0	0	3
Be tested twice a year	0	1	0	0	1
Be tested at discretion of inspector	0	0	1	0	1

CLEANLINESS OF COWS

Eighty-four cities require that udders be washed before milking. 81 cities require that the udders be wiped with a damp cloth before milking, and 147 cities simply require that the udders be clean. 33 cities require that hair be clipped from the udders.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations specifying that					
Udders be washed before milking	51	23	10	0	84
Udders be wiped with damp cloth before milking	48	25	8	0	81
Udders be cleaned with dry cloth	17	4	2	0	23
Hairs on udders be clipped	17	13	2	1	33
Manure be removed from body of cow	30	15	7	3	55
Udders be clean	70	53	20	4	147

STABLES

Two hundred and three cities specify that stables must be clean; 49 require that clean bedding be provided; 173 require that stables be well ventilated, 165 that stables be well lighted, and

only 33 specify the amount of window space to be provided per cow. The glass so required varies from 2 to 6 square feet. 10 cities favored 3 square feet and 12 cities 4 square feet window space for the space occupied by one cow. 86 cities specify the minimum air space per cow. The required space varies from 100 cubic feet per cow to 1,000 cubic feet per cow. Eighty per cent of the cities require 500 cubic feet or more. 52 cities require 500 cubic feet. One city requires 1½ cubic feet of air space for every pound of live weight of the cow.

One hundred and seventeen cities require that stables be free from manure. 119 cities require tight, sound stable floors. 134 cities require stable floors to be well drained. Only 51 cities require tight, clean ceilings. The regulations of 138 cities require the removal of manure from the stable, but 40 of these regulations do not specify how often manure shall be removed. Of 96 cities which require the manure removed each day, 50 require it removed once daily and 46 twice daily. 42 cities specify the distance from the stable to which the manure shall be removed. The distance varies from 10 feet to 300 feet, but most requirements specify a distance of from 30 to 50 feet.

One hundred and thirty-two cities specify that whitewashing of the stable is necessary. Some cities require it once in three months, and others once in two years. Approximately one-third of the cities require the stables to be whitewashed every year, and another one-third, every six months. The detailed information follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring					
That stable be clean	118	63	19	3	203
That clean bedding be provided	26	14	8	1	49
That stable be well ventilated	86	64	21	2	173
That stable be well lighted	88	54	20	3	165

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring					
2 square feet of glass per cow	6	2	1	0	9
3 square feet of glass per cow	4	4	1	1	10
4 square feet of glass per cow	6	2	4	0	12
6 square feet of glass per cow	1	0	0	1	2
Number of regulations in which glass area is not mentioned	71	46	13	2	132
Number of regulations requiring that					
Stable be free from cobwebs	29	17	6	0	52
Stable be free from dust	40	20	7	0	67
Stable be free from manure	63	44	9	1	117
Stable have tight sound floors	64	36	16	3	119
Floors be well drained	71	39	21	3	134
Walls be tight and clean	14	15	2	3	34
Ceilings be tight and clean	24	17	7	3	51
Number of regulations requiring "proper" air space	54	32	19	1	106
Number of regulations in which amount of air space is not specified	9	7	23	0	39
Number of regulations requiring					
1,000 cubic feet space per cow	2	1	1	0	4
600 cubic feet space per cow	4	6	3	0	13
500 cubic feet space per cow	30	11	11	0	52
400 cubic foot space per cow	3	6	2	0	11
350 cubic feet space per cow	1	1	0	0	2
300 cubic feet space per cow	2	0	0	0	2
100 cubic feet space per cow	1	0	0	0	1
demanding proper air space but no amount specified	0	0	2	0	2
1½ cubic feet air space for every pound of live weight	0	0	0	1	1
Number of regulations requiring the whitewashing of stable	74	38	17	3	132
Number of regulations in which the time between whitewashings is not specified	16	7	9	2	34
Number of regulations requiring whitewashing of stable					
Every 2 years	1	5	0	0	6
Every year	27	14	1	0	42
Every 6 months	29	12	6	1	48
Every 3 months	1	0	0	0	1
Frequently	0	0	1	0	1
Number of regulations requiring that no other animals should be allowed in the stable	71	37	14	2	124

Removal of manure from stables

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring the removal of manure	70	48	17	3	138
Number of regulations not stating how often manure must be removed	16	18	5	1	40
Number of regulations requiring removal of manure once daily	26	21	3	0	50
Twice daily	28	8	8	2	46
Weekly	0	1	0	0	1
Frequently	0	0	1	0	1
Number of regulations requiring manure to be removed					
300 feet	0	2	1	0	3
200 feet	0	1	1	0	2
100 feet	1	3	0	0	4
75 feet	0	0	1	0	1
60 feet	0	2	0	0	2
50 feet	2	4	4	0	10
40 feet	1	4	0	0	5
30 feet	4	7	1	0	12
10 feet	1	1	0	0	2
Away	0	0	1	0	1

STABLE YARDS

With reference to the barnyard, 93 cities require them to be clean, 66 require them to be well drained, 74 require them to be free from manure piles, and 50 require them to be free from stagnant water.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring barnyard to be					
Clean	45	40	8	0	93
Well drained	30	21	13	2	66
Free from manure piles	29	31	12	2	74
Free from stagnant water	21	20	8	1	50

WATER SUPPLY

Regarding the water supply for the dairy farms, 107 cities require that it be clean, 30 cities that it be fresh, 12 cities that it be convenient, 53 cities that it be abundant, 98 cities that it be free from contamination, and 14 cities that it be pure. The information in detail is as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that water supply be					
Clean	70	26	11	0	107
Fresh	23	3	4	0	30
Convenient	7	0	4	1	12
Abundant	29	14	9	1	53
Free from contamination	54	30	12	2	98
Pure	0	6	8	0	14
Well chosen	0	1	0	0	1
Suitable	0	1	0	0	1

MILKERS

The regulations of 190 cities require that milkers be free from disease. 131 cities require that they be clean. 108 cities require that they wear clean clothes, and 111 cities require that they wash their hands before milking. Seventy-nine cities require the milking to be done with clean dry hands.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that					
Milker be free from disease	109	54	22	5	190
Milker be clean	78	40	13	0	131
Milker wear clean clothes	61	34	12	1	108
Milker wash hands before milking	52	41	16	2	111
Milker brush nails before milking	8	4	2	0	14
Milking be done with clean dry hands	46	22	10	1	79
Hands be not wet during milking	12	22	4	0	38

MILK HOUSE

Most cities requiring milk houses specify that they be located apart from stables or privies. The shortest distance from stable permitted varies from 10 to 100 feet. The average distance is 34 feet. The shortest distance from a privy at which a milk house can be legally located varies from 10 to 300 feet. The average distance is 90 feet.

Proper ventilation, lighting, screening, tight sound floors and good drainage are by far most frequently mentioned in the requirements regarding construction of milk houses. 150 cities require that milk houses be used only for the handling of milk, and 232 cities require that milk houses be kept clean.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that milk houses be					
Clean	132	75	22	3	232
Used for no other purpose	82	46	19	3	150
Have tight sound floor	46	27	13	1	87
Be well ventilated	62	27	11	1	101
Be well lighted	51	24	11	1	87
Be well drained	36	20	14	1	71
Number of regulations requiring sterilizing equipment in the milk house	13	16	2	0	31
Number of regulations requiring that milk house be					
Well screened	63	44	16	2	125
Provided with suitable racks	5	4	6	0	15
Provided with cooling tanks	8	12	5	1	26
Located a certain distance from the stable	45	15	11	0	71
Number of regulations requiring milk house to be located					
100 feet from stable	3	2	0	0	5
50 feet from stable	4	0	1	0	5
40 feet from stable	1	0	0	0	1
25 feet from stable	1	0	1	0	2
20 feet from stable	1	0	0	0	1
15 feet from stable	1	0	0	0	1
12 feet from stable	0	0	1	0	1

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring milk house to be located					
10 feet from stable	1	0	1	0	2
Away from stable	28	10	2	0	40
At a distance from stable	2	0	0	0	2
With an air space between milk house and stable	1	0	0	0	1
Apart	1	3	0	0	4
Distance not given	1	1	5	0	7
Number of regulations requring that					
Milk house be free from odors	52	22	6	0	80
No swine be within a stated distance	27	7	0	1	35
No swine be within 100 feet	1	0	0	0	1
No swine be within 50 feet	26	0	0	0	26
Swine be "not near"	0	0	1	0	1
Number of regulations requiring that milk house					
Be a separate room	74	48	26	3	151
Be a distance from privy	56	40	13	1	110
300 feet from privy	0	1	0	0	1
200 feet from privy	1	0	0	0	1
100 feet from privy	2	3	1	0	6
75 feet from privy	0	0	1	0	1
50 feet from privy	4	1	1	1	7
40 feet from privy	2	0	0	0	2
25 feet from privy	2	3	0	0	5
15 feet from privy	2	3	0	0	5
10 feet from privy	0	0	1	0	1
Away from privy	16	18	0	0	34
Not near privy	6	1	0	0	7
Distant	21	0	0	0	21
Not mentioned	0	10	9	0	19

MILK UTENSILS

Fifty-eight cities require utensils of non-absorbent material. 30 cities require that dairy utensils have round or smooth joints. 62 cities require that dairy utensils be "well constructed." Only about 15 per cent of the cities fail to prescribe the use of clean utensils. The regulations of 206 cities specify that dairy utensils be clean. 165 cities specify that they be washed, 93

cities specify that utensils be scalded, and 226 specify that dairy utensils be sterilized. 109 cities require that dairy utensils be used for no other purpose, and 120 cities require their protection from contamination.

Construction of utensils

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that only round cornered utensils be used	6	5	0	0	11
Number of regulations requiring that only utensils with smooth joints be used	5	4	7	3	19
Number of regulations requiring that utensils be made of non-absorbent material	36	15	7	0	58
Number of regulations requiring that utensils be well constructed	30	17	14	1	62
Cleaning of utensils					
Number of regulations requiring that utensils be					
Clean	112	71	22	1	206
Washed	94	52	17	2	165
Scalded	48	28	14	3	93
Sterilized	121	73	25	7	226
Used for no other purpose	56	33	17	3	109
Protected from contamination	52	51	16	1	120
Number of regulations represented in the above items	184	114	37	7	342
Number of regulations containing nothing regarding the cleaning of utensils	50	11	5	1	67
Milk straining					
Number of regulations requiring milk to be strained in milk house only	38	31	5	0	74
Number of regulations requiring milk to be strained					
Outside the barn	3	2	3	0	8
Immediately	44	38	12	0	94
Through cotton	6	4	1	0	11
Through flannel	6	2	0	0	8
Through cheese cloth	5	11	3	0	19
Through wire	5	7	1	0	13

The milk

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that					
Milk be removed immediately from barn	89	45	17	3	154
Milk be cooled immediately	89	61	18	3	171
Milk be aerated	23	11	6	0	40
Fore milk be discarded	4	6	6	1	17
Milk must not be strained in barn	4	4	2	1	11
Milk must be stored only in milk house	9	33	6	0	48
Milk be milked into covered pails	20	14	8	2	44
Milk be graded	0	5	4	0	9

THE SCORING OF DAIRY FARMS

The dairy farm score card system of inspection is required by 56 cities. The score card developed by this association and generally introduced by the U. S. Department of Agriculture is almost universally used in the 56 cities. It is interesting also in this connection to note that the score card system is used by 184 other cities that do not have regulations requiring its use. 56 cities require a minimum score as follows:

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Minimum score of dairy farms					
80	2	1	0	0	3
75	1	0	0	0	1
65	2	0	1	1	4
60	8	12	3	0	23
55	0	2	1	1	4
50	3	1	0	0	4
46	0	0	1	0	1
45	3	2	0	0	5
40	6	4	0	0	10
Not given	1	0	0	0	1

CITY MILK PLANTS

The principal requirements call for proper lighting, ventilation, screens, tight floors, drains, and proper equipment. Each of these conditions is included in about one-third of the regulations. 70 cities specify that city milk plants must be clean. 10 cities specify that such plants be free from flies, and 15 cities require facilities for cleaning utensils in plant. 13 cities have adopted the score card system of milk plant inspection, and require scores of from 40 to 75 points. A score of 70 points is required in 5 cities.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that milk plant shall					
Be well lighted	9	8	7	2	26
Be well ventilated	6	7	6	2	21
Be well screened	10	18	6	1	35
Be well drained	7	8	6	2	23
Be properly constructed	2	7	5	2	16
Be properly equipped	8	6	8	0	22
Be clean	19	27	19	5	70
Be free from flies	5	1	2	2	10
Be free from odors	4	1	2	1	8
Be free from contamination	2	3	1	2	8
Have sewer connections	2	3	2	0	7
Have facilities for cleaning utensils in plant	2	5	5	3	15
Have facilities for storing milk in plant	3	2	0	2	7
Have running hot and cold water	2	5	1	1	9
Have separate room for handling milk	4	2	5	1	12
Have tight walls and ceilings	2	5	6	1	14
Have tight floors	9	7	7	2	25
Score a certain number of points	5	5	3	0	13
Shall score not less than					
40 points	0	1	0	0	1
50 points	1	1	0	0	2
60 points	0	1	1	0	2
70 points	2	2	1	0	5
75 points	0	0	1	0	1
not mentioned	2	0	0	0	2

DELIVERY WAGONS

Two hundred and seventeen cities require the name of the dealer on delivery wagons. 232 cities specify that the number of dealer's license must appear on wagon. 158 cities require clean wagons and 85 require covered wagons. In 177 cities the drivers are required to be free from disease.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring					
Drivers to be free from disease	110	53	14	0	177
Wagons to be covered	42	30	12	1	85
Wagons to be clean	88	52	15	3	158
Wagons not to haul refuse or be used for any other purpose	61	41	14	0	116
Name of dealer to appear on wagon	112	78	23	4	217
Number of license to appear on wagon	123	74	29	6	232

LABELING AND SALE

Seventy-seven cities require milk to be sold in bottles only on the street, and 80 cities specify that milk be sold only in bottles in stores. Other cities permit sale from cans; 22[illegible] cities require skimmed milk to be labeled as such; and 132 cities specify the heights of the letters. 81 cities require such letters to be one inch high, and 46 cities require the letters to be at least 1½ inches or higher.

Only 93 cities specify that milk tickets shall be used only once. 316 cities fail to state how milk tickets, if used, shall be used. 42 cities require the name of the dealer to appear on bottle caps. 24 require the license number to be printed on caps. 18 require the date of bottling printed on caps. 27 require the grade of milk to be indicated on caps. 30 state that bottle caps must be clean. 19 cities require the name of the dealer to be blown into the glass in making bottles. 179 cities permit bottles to be filled with milk only at the plant.

71 cities require bottles to cleansed by consumers immediately after emptying.

Forty-four cities require that pasteurized milk be labeled as such; and 67 cities specify the temperatures to which milk shall be heated and time milk shall be held when pasteurized.

Store milk

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring					
Milk to be sold in bottles only	45	20	13	2	80
Bottles to be covered in store	31	10	12	3	56
Refrigerator to be clean	0	0	0	3	3
Milk tickets					
Number of regulations requiring that milk tickets be used but once	49	34	9	1	93
Number of regulations not limiting the use of tickets	185	91	33	7	316
Skimmed milk					
Number of regulations requiring cans and bottles to be marked	116	74	29	5	224
Number of regulations prescribing heights of letters	66	42	21	3	132
Number of regulations requiring letters					
4 inches high	2	1	0	0	3
3 inches high	8	10	4	0	22
2 inches high	5	7	4	0	16
1½ inches high	4	1	0	0	5
1 inch high	44	21	13	3	81
½ inch high	3	0	0	0	3
¼ inch high	0	2	0	0	2
Milk bottles					
Number of regulations requiring that bottles be sealed before using	25	12	15	1	53
Number of regulations requiring that					
Name of dealer appear in the glass	9	6	4	0	19
Bottles be filled at plant only	76	72	28	3	179
Bottles be cleansed immediately after emptying by consumer	27	29	12	3	71

Bottle caps

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations requiring that name of dealer be printed on bottle caps	16	15	9	2	42
Number of regulations requiring that license number of dealer be printed on bottle caps	15	7	2	0	24
Number of regulations requiring that date of bottling be printed on bottle caps	7	6	5	0	18
Number of regulations requiring that grade of milk be printed on bottle caps	14	10	3	0	27
Number of regulations requiring that bottle caps be clean	10	14	3	3	30

Street milk

Number of regulations requiring milk to be sold in bottles only	45	22	10	0	77
Number of regulations requiring that bottles be covered	30	10	10	0	50

Pasteurized milk

Number of regulations requiring that pasteurized milk be labeled	17	16	6	5	44
Number of regulations requiring that in pasteurizing milk be heated and held for a certain time and at a given temperature	27	22	13	5	67

PENALTIES

In providing penalties for the violation of rules and regulations, 241 cities provide for either jail sentences or fines, or both. The fines vary from $1.00 to $1,000 and the jail sentences from three days to six months. One hundred and sixty-eight cities do not provide for penalties.

	POPULATION				TOTAL CITIES
	5,000 to 25,000	25,000 to 100,000	100,000 to 500,000	Over 500,000	
Number of regulations prescribing fines or penalties	125	75	36	5	241
Number of regulations not prescribing penalties.....	109	50	6	3	168
Fines in the regulations studied varied from.....	$1 to $500	$5 to $500	$1 to $1,000	$5 to $200	$1 to $1,000
Jail sentences...	3 days to 6 months	10 days to 6 months	5 days to 6 months	60 days	3 days to 6 months

Two hundred and twenty-three cities with populations between 5,000 and 100,000 report they have no regulations of any kind governing the sale of milk or cream.

One health officer, apologizing for his inability to send a copy of his city ordinance, stated: "Our city council is ossified and waits on the tail of progress."

Another says: "We have no regulations regarding the sale of milk and cream, and I am unable to get the city council to do anything in the matter."

Your committee on Statistics of Milk and Cream Regulations has also prepared in tabulated form the principal facts found in the laws and regulations of 29 states in so far as they pertain to the production, handling and sale of milk and cream. This tabulated summary is included as a part of this report, and is as follows:

SURVEY OF MILK AND CREAM REGULATIONS OF STATES

Number of states represented in this survey (including Philippine Islands)....	29
Number of complete regulations of states studied.....	29
Number of states not reporting milk and cream regulations.....	20

Milk licenses

Number of states requiring licenses or permits for the sale of milk	11
Number failing to mention or not requiring a license	18
Number of regulations which state that license is issued annually	9
Number of regulations which fail to state how often license is issued	20

Licenses and fees

Number of states requiring fees	8
Number of states not requiring fees	21
Number of states charging	
$0.50 annually	1
1.00 annually	2
2.00 annually	1
1.00 each wagon	1
1.00 each wagon and store	2
1.00 each wagon, store and depot	1
Number of states requiring license or permit for each place of business	4
Number of states not requiring such permits	25
Number of states requiring inspection of distributing plant and dairies before granting licenses	2
Number of states not requiring such inspection	27

Chemical requirements.

Number of regulations limiting percentage of water	7
Number of regulations not regulating or stating percentage of water permitted	22
Number of regulations limiting percentage of water to	
89.00 per cent	1
88.50 per cent	1
88.25 per cent	1
88.00 per cent	1
87.51 per cent	1
87.05 per cent	1
87.00 per cent	1
Number of regulations establishing legal minimum for total solids	12
Number of regulations not having or not stating a legal minimum for total solids	17
Number of regulations requiring a legal minimum for total solids of	
13.00 per cent	1
12.51 per cent	1
12.50 per cent	1
12.15 per cent	1
12.00 per cent	5
11.75 per cent	2
11.50 per cent	1
Number of regulations establishing a legal minimum for solids not fat	15

Number of regulations not having or stating a legal minimum for solids not fat..... 14
Number of regulations requiring a legal minimum for solids not fat of
9.25 per cent..... 1
8.75 per cent..... 2
8.50 per cent..... 11
8.00 per cent..... 1
Number of regulations establishing a legal minimum for fat..... 25
Number of regulations not having or stating a legal minimum for fat..... 4
Number of regulations requiring a legal minimum for fat of
3.50 per cent..... 3
3.35 per cent..... 1
3.25 per cent..... 11
3.20 per cent..... 2
3.00 per cent..... 8
Number of regulations establishing a legal minimum for fat in cream..... 22
Number of regulations not having a legal minimum for fat in cream..... 7
Number of regulations requiring a legal minimum for fat in cream of
20.0 per cent..... 1
18.0 per cent..... 17
16.0 per cent..... 3
15.0 per cent..... 1
Number of regulations in which the size of the sample to be taken was stated.. 1
Number of regulations calling for 8 oz. sample..... 1

Bacterial limits

Number of regulations establishing a numerical limit for bacteria in milk.... 4
Number of regulations not having or stating a numerical limit for bacteria in milk..... 25
Number of regulations limiting the number of bacteria per cubic centimeter to
200,000..... 1
500,000..... 2
1,000,000..... 1
Number of regulations establishing a numerical limit for bacteria in cream... 2
Number of regulations not having or stating a numerical limit for bacteria in cream..... 27
Number of regulations limiting the number of bacteria per cubic centimeter in cream to
200,000..... 1
500,000..... 1

Temperature requirements

Number of regulations requiring a certain temperature for milk on farm.... 2
Number of regulations not having or requiring a certain temperature for milk on farm..... 27
Number of regulations calling for a temperature not higher than
60°F..... 1
58°F..... 1

Number of regulations requiring a certain temperature for milk on common carriers	3
Number of regulations not having or requiring a certain temperature for milk on common carriers	26
Number of regulations calling for a temperature not higher than	
70° F	1
60° F	1
55° F	1
Number of regulations requiring a certain temperature for milk in city	3
Number of regulations not having or requiring a certain temperature for milk in city	26
Number of regulations calling for a temperature not higher than	
70° F	1
60° F	1
55° F	1
Number of regulations establishing a legal minimum specific gravity for milk	3
Number of regulations requiring a legal specific gravity of	
1.029–1.033	2
1.029	1
Number of regulations which forbid the sale of milk under stated conditions	29
Number of regulations which do not mention when milk is unsalable	0
Number of regulations which mention milk from diseased cows	24
From cows kept in filthy quarters	15
Containing visible dirt	3
From cows kept in crowded and unhealthy stables	16
When adulterated	21
From cows fed distillers' grains	11
From cows fed swill	2
From cows a certain number of days before calving	21
From cows a certain number of days after calving	21
Containing foreign substance	22
From cows eating putrefactive feeds	14
From cows when feed is unwholesome	14
From cows when feeds are impure	9
From cows when fed on refuse	3
From cows when fed glucose	2
From cows when fed garbage	4
From cows when fed wet brewers' grains	7
From cows drinking contaminated water	12
From cows when fed vinegar waste	2
From cows when fed starch waste	2
From cows when fed sugar waste	2
That is diseased	1
That is bloody	1
That is tainted	1
That is unclean	8
That is unnatural	1

That is decomposed..... 2
That is unhealthy..... 8
That is stringy..... 2
Total number of conditions and feeds which render milk unsalable..... 29

Parturition

Number of regulations which state a specific number of days before and after parturition during which milk cannot be sold..... 21
Number of regulations which do not cover this point..... 8
Number of regulations prohibiting the sale of milk
30 days before parturition..... 1
15 days before parturition..... 15
14 days before parturition..... 2
10 days before parturition..... 2
8 days before parturition..... 1
Total..... 21
Number of regulations prohibiting the sale of milk
15 days after parturition..... 1
10 days after parturition..... 6
7 days after parturition..... 1
5 days after parturition..... 11
4 days after parturition..... 2
Total..... 21

Fines

Number of regulations prescribing fines or penalties..... 22
Number of regulations not prescribing penalties..... 7
Fines in regulations studied varied from $5 to $300
Jail sentences mentioned 10 days to 3 yrs.

Construction of utensils

Number of regulations which require that only utensils with smooth joints be used..... 2
Number of regulations which require that utensils be made of non-absorbent material..... 2
Number of regulations which require that utensils be well constructed..... 6

Cleaning of Utensils

Number of regulations requiring that utensils be
Clean..... 17
Washed..... 6
Scalded..... 3
Sterilized..... 3
Used for no other purpose..... 7
Protected from contamination..... 2

Number of regulations represented in the above items..... 21
Number of regulations not referring to the cleaning or care of utensils..... 8

Milk plant

Number of regulations requiring that milk plant
- Be clean..... 5
- Be free from odor..... 1
- Have a certain score (Score required, 50)..... 1

Wagons

Number of regulations requiring that driver be free from disease..... 5
Number of regulations requiring that
- Wagon be covered..... 1
- Wagon be clean..... 3
- Wagon not to be used for any other purpose..... 1
- Name of dealer must appear on wagon..... 6
- License number must appear on wagon..... 4

Street milk

Number of regulations requiring that milk must be sold in bottles only..... 1
Number of regulations requiring that bottles must be covered..... 1

Store milk

Number of regulations requiring that milk be sold in bottles only..... 2

Milk tickets

Number of regulations requiring that milk tickets be used but once..... 1
Number of regulations which do not limit the use of tickets..... 28

Skimmed milk

Number of regulations which require that cans and bottles be marked..... 15
Number of regulations prescribing heights of letters..... 11
Number of regulations requiring letters
- 2 inches in height..... 1
- 1 inch in height..... 8
- ½ inch in height..... 1
- ⅛ height of container..... 1

Milk bottles

Number of regulations requiring that bottles
- Be sealed before using..... 2
- Have name of dealer blown into bottle..... 4
- Be cleansed immediately by consumer..... 2
- Be filled at plant only..... 2

Bottle caps

Number of regulations requiring that date of bottling be printed on bottle caps	1
Number of regulations requiring that bottle caps be clean	2

Farm regulations

Number of regulations requiring that cows be tuberculin tested	1
Number of regulations requiring that minimum score of dairies be required	4
Number of regulations requiring that minimum score of dairies be	
80	1
50	2
40	1

Cleanliness of cows

Number of regulations requiring that udders be washed before milking	2
Number of regulations requiring that udders be	
Wiped with damp cloth	1
Cleaned with dry cloth	1
Number of regulations requiring that udders be clean	8

Cow stables

Number of regulations specifying that stable be	
Clean	9
Well ventilated	7
Well lighted	5*
Number of regulations requiring that stables	
Be free from dust	2
Be free from manure and odor	5
Have tight sound floors	1
Have floors well drained	2
Have tight clean walls	1
Have tight clean ceilings	1
Number of regulations requiring the removal of manure	3
Number of regulations requiring removal once daily	2
twice daily	1
Number of regulations requiring that manure be removed not less than 200 ft. from stable	1
Number of regulations calling for whitewashing stable	3
Number of regulations calling for whitewashing	
Every two years	1
Annually	2
Number of regulations stating that no animals other than cows be allowed in the stable	3

*Area of window space per cow not mentioned.

Milk house

Number of regulations requiring that milk house be	
Clean	6
Used for no other purpose	4
Well ventilated	2
Well lighted	2
Well drained	1
Number of regulations calling for sterilising equipment in the milk house	1
Number of regulations requiring that milk house be well screened	3
Number of regulations requiring that milk house be located a certain distance from the stable	3
Number of regulations requiring milk house to be "away" from stable	3
Number of regulations requiring that milk house be free from odors	3
Number of regulations requiring that milk house	
Be a separate room	4
Be a distance from privy	1
Number of regulations requiring a location	
100 feet from privy	1
50 feet from privy	1
Away from privy	2

The milk

Number of regulations requiring that milk be removed immediately from the barn	2
Number of regulations requiring that milk be	
Cooled immediately	3
Aerated	1
Milked into covered pails	1
Number of regulations requiring that fore milk be discarded	1
Number of regulations requiring that milk be stored only in milk house	3
Number of regulations requiring that milk be graded	1

Milk straining

Number of regulations requiring that milk be strained immediately	1
Number of regulations requiring that milk be strained	
Through cotton	1
Through flannel	1
Through wire	2

The milker

Number of regulations requiring that milker be	
Free from disease	6
Clean	4
Wear clean clothes	2
Wash hands before milking	1
Number of regulations requiring that milking be done with clean dry hands	1

Barnyard

Number of regulations requiring that barnyard be	
Clean	3
Well drained	1
Free from manure piles	2
Free from stagnant water	2

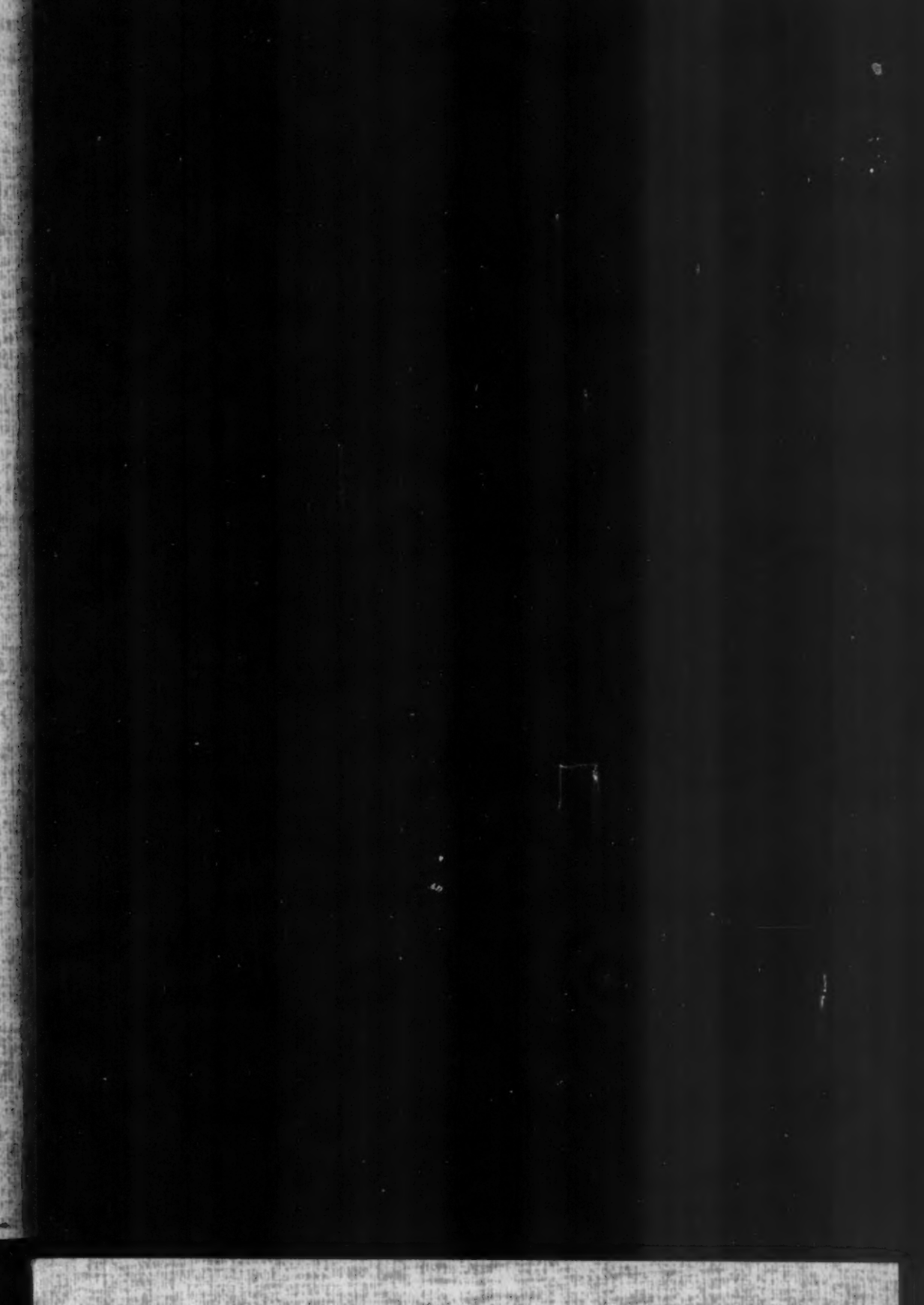
Water supply

Number of regulations requiring that water supply be	
Clean	4
Fresh	2
Free from contamination	2
Pure	2

Pasteurized milk

Number of regulations requiring that pasteurized milk be labeled	1
Number of regulations specifying that in pasteurizing milk be heated and held for a certain time and at a given temperature	3

In conclusion, your committee would state that it does not understand it to be within its province to outline or to present recommendations at this time for the correction of the glaring irregularities so frequently observed in regulations pertaining to the same subject; but out of this survey of milk and cream regulations of the cities and towns and states of the United States, with a full realization of the magnitude of the industry and the factors which make for improved quality, this committee has become convinced that

First, there is a great and urgent need for further research and study on the part of our dairy investigators of some of the problems involved in the production and handling of milk; and

Second, there is a great and urgent need that definite information now available be placed in the hands of all who are responsible for the laws and ordinances governing the production, transportation, handling and sale of milk.